

Journal of the Society of Chemical Industry.

No. 20, Vol. XXXV.

OCTOBER 31, 1916.

No. 20, Vol. XXXV.

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Official Notice.

REPORTS OF THE PROGRESS OF APPLIED CHEMISTRY.

The first volume of the Reports of the Progress of Applied Chemistry is now in active preparation, and will, it is hoped, be published in December. It will cover recent progress to the end of June, 1916. The second volume will deal with the period up to the end of 1917, and subsequently it is proposed to issue the Reports annually.

The Reports will present a critical summary of the progress that has been made in the various branches of chemical industry during the period in question. It has not been found practicable to treat every section of the Journal classification, agricultural chemistry, the chemistry of foods, and analysis are fully dealt with in the admirable series of Reports issued annually by the Chemical Society, and for the present there will be no sections on general plant and explosives.

The following is a list of the subjects which will be dealt with, together with the names of the experts who are contributing to this volume:—

Fuel—J. W. Cobb, B.Sc.
Gas, destructive distillation, tar products—E. V. Evans, F.I.C.
Mineral oils—A. W. Eastlake.
Dyestuffs—G. T. Morgan, D.Sc., F.R.S.
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Glass, ceramics, cement, etc.—J. A. Audley, B.Sc.
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Photographic materials and processes—B. V. Storr, M.Sc.

The price of issue will be, to members, 2s. 6d. (plus 6d. postage), and non-members, 5s. (plus 6d. postage). As the issue is to be a limited one, those desirous of securing copies are requested to fill in the order form attached to the cover of the Journal, and return it to the Secretary at an early date.

Editorial.

RUBBER—NATURAL AND SYNTHETIC.

The papers communicated by Messrs. Luff and Puritt to the Edinburgh Section of this Society, and printed in the last issue of the Journal, present in a comprehensive form some of the difficulties against which the rubber chemist has to contend. The efforts that have been made during recent years to produce rubber by synthesis have been of the most absorbing interest to chemists. The problem is one which presents greater difficulties than are usually experienced in synthetic chemistry, since in the first place the exact constitution of the caoutchouc molecule has not yet been determined, owing to its colloidal

nature, and secondly the commercial value of rubber depends almost entirely on its physical characteristics and only to a very minor degree on its chemical properties. As early as 1879 Bouchardat succeeded in producing a substance similar to caoutchouc in composition and properties, by the action of hydrochloric acid on isoprene; since that time a large number of methods have been devised for converting isoprene, as well as its lower and higher homologues, butadiene and dimethylbutadiene, into caoutchouc-like products. Of the products thus obtained, that from butadiene appears to be the most satisfactory from the point of view of physical properties though of course it is not chemically identical with natural caoutchouc. Again, the polymerising agent used has a considerable effect on the properties of the resulting product; many substances have been suggested for this purpose, particularly sodium and acetic acid, sodium appearing to give the most satisfactory results.

But the chief difficulty which has to be surmounted is the production of isoprene at a sufficiently low price to enable the synthetic rubber to compete with natural rubber. It is computed that plantation rubber can be produced profitably at from 1s. to 1s. 3d. per lb., so that it is essential to find a cheap and abundant source of isoprene or its homologues. The earlier experiments were made with turpentine, but yields were low and supplies became somewhat limited. Coal tar would appear to be out of the question (this J., 1916, 985), and whilst petroleum provides the necessary hydrocarbons, the increasing use of the lighter products as motor fuels may prevent their extended adoption in other directions. Starch and cellulose would thus seem to be the most promising raw materials for the purpose, and methods of preparing isoprene from these sources have been worked out (*loc. cit.*).

Even when these problems have reached a satisfactory conclusion, it will remain to produce a product which the rubber manufacturer can substitute for natural rubber. It will probably be necessary to incorporate with the synthetic product the necessary amount of resins and possibly the nitrogenous constituents before a satisfactory product is obtained (this J., 1916, 987); even then, however, it is not certain that the product will possess the "nerve" which is so important a property of natural rubber.

Whilst these efforts to produce an artificial rubber have been in progress, it is satisfactory to note that those engaged in the production of natural rubber have not been standing idly by and watching events. One of the greatest difficulties with which the rubber manufacturer has to contend is lack of uniformity in the raw material. This lack of uniformity results in variation of vulcanising properties, which in turn leads to variations in strength of the finished product, since it would be impracticable to alter the conditions of treatment to suit each individual batch. A considerable amount of research work has been and is being carried out with a view to the production of a uniform product, and it is to be hoped that improved methods of collection and coagulation may be devised that will bring about the desired result. The planters, too, have availed themselves of scientific methods in selection and cultivation of the trees, and have increased their production from 28,500 tons in 1912 to 98,000 tons in 1915 (the production of other kinds of rubber has remained stationary at about 50,000 tons per annum). Provided that scientific methods and research are applied vigorously and continuously to this industry, there does not seem to be much immediate danger that it will suffer the fate which has overtaken the natural indigo industry.

Annual Meeting.

THE PROGRESS OF THE BRITISH RARE EARTH INDUSTRY DURING THE WAR.

BY SYDNEY J. JOHNSTONE.

(See this Journal, July 31st, 1916, pp. 811-813.)

Reply to discussion.

Mr. S. J. JOHNSTONE, who was not present when his paper was read, in a written reply states:—
"As regards Professor Louis' criticism of my estimate of the cost of producing 90% monazite sand from the Travancore Minerals Co.'s concessions, I have every reason to believe that the figure which I gave, i.e., £4 per ton f.o.b., is very nearly correct. This amount does not include such items as royalty to the Travancore Government, directors' fees, office expenses, agents' commission, etc. I understand that for a number of years, until shortly before the outbreak of war, the sand was regularly produced for the Company, by a contractor, at a price very close to the amount quoted above.

"The other concessions recently granted, in Travancore, are to be operated by a Company called Hopkin and Williams (Travancore), Ltd., whilst Thorium Ltd. will confine its attention to the manufacture of thorium salts and allied products. The latter Company is manufacturing thorium nitrate from monazite sand, but I understand that it is premature to state that this is being obtained from the recently granted concessions in Travancore."

Edinburgh Section.

Meeting held at Edinburgh University on Wednesday, October 4th, 1916.

PROF. JAS. WALKER IN THE CHAIR.

THE ORGANISATION OF BRITISH CHEMICAL MANUFACTURES.

BY SIR CHARLES BEDFORD, D.Sc., LL.D., GENERAL SECRETARY, ASSOCIATION OF BRITISH CHEMICAL MANUFACTURERS.

I am not going to attempt to offer more than very general reasons for the necessity for the formation of a special Association to carry out the organisation of chemical industries in this country. For the best evidence to my mind of the necessity of combination for mutual advantage in this industry is the fact that practically all the chief chemical manufacturers in the country, who are after all the best judges of such matters, have hastened to join our Association, and that we have in our council some of the ablest and most progressive representatives of the British chemical industry.

Sir Robert Borden, the Canadian Premier, has described only too truly the British Empire as a mere disorganisation, whose industries are not related, and have no economic coherence. Our German enemies offer, on the other hand, the best examples of highly organised industries. It is held that this organisation is merely an extension and adaptation of their highly elaborated army machinery, but in any case we have only too bitter reason to deplore its efficient and practical success, largely, if not chiefly, at our expense in the

industrial field. But the German has a natural bent towards combination and reaps the advantages due to union being strength. In Great Britain initiative has been essentially private and when we were not confronted, as we now are, with a highly developed and most intensely hostile organisation it worked well, as it more or less had the field to itself. That state of affairs can never return, and now we must set to work to learn from the successes of our enemies what to adopt and what to reject in order to safeguard and properly develop our industrial future. No one suggests for a moment slavish imitation, but merely a critical stock-taking and review, for we can no longer hope to fight an efficient organisation by means of disorganisation, and it is admitted that we have failed to keep pace with our competitors in industrial chemistry. In Germany, practically every manufacture and trade has its own organised association and also one or more special trade journals. By these and other means manufacturers in the same line are brought either into personal touch or put into communication with each other. Home and foreign markets are studied and new opportunities carefully exploited. It is found that co-operation is a paramount necessity in certain keenly competitive businesses. The more they specialise in certain lines of production the greater is this necessity. Further, markets are scientifically studied by syndicates controlling production and sales and when the home market is fully supplied then foreign outlets are developed by "dumping" and otherwise, as we all know to our cost. Combinations are held to make for cheap production, and this is often effected not only by the large scale of production but by the development of by-products. By entering such a combination it is possible to be able to afford effective research, and when tariffs and Government assistance are also available for the protection and fostering of industry—whether developing or full grown—the handicap to rivals working unaided and on a small scale is overwhelming in most instances. In addition to such aids, we see transport facilities by sea, river, canal, and railways, given on a far-reaching scale, and in the most effective manner. And in addition there is trained diplomatic and consular support of a vigorous kind to back the German trader at every turn. Again we have to note the systematic efforts to teach the science of international trading. You are probably aware of the comparatively recent initiation of two German institutes—one is the Institut für Seeverkehr und Weltwirtschaft. The other is the Weltwirtschaftliche Gesellschaft. Both were started in 1914 with the object of teaching international trading. And there are combinations of trading societies in order that they may learn from each other's trading experience and form leagues of the various interests in order authoritatively to place their views before the Government. Systematic commercial intelligence operations are conducted on a considerable scale. Overseas branch factories are established for producing the products required by those special markets and of which the enormous South-American electrical combine is perhaps the most striking instance. These are, broadly, the lines along which the Teuton has worked with, it must be admitted, enormous advantage. It is our clear duty to examine how far we may profit by this system and to what extent we should adapt it to our own needs. Comparatively recently Germans have announced a combination of all their leading chemical works, and we know that that amounts to a declaration of industrial war after the war. No effort will be spared and all national aids will be brought to bear more ruthlessly than ever to recover, consolidate, and extend their hold over the world's chemical industries.

But it is not by any means Germany alone that we have to fear in this life-and-death struggle. For, as we know, chief among our rivals is the United States. They are working feverishly to make the most of the present opportunities and of future possibilities. As examples, trade associations are being actively formed; and, regarding the application of science to industry, the American Chemical Society's Central Committee has been appointed by representatives of the universities and industries to study opportunities and to make public recommendations for researches on industrial problems common to specific industries which would be conducted in universities and the results published for the common use of the manufacturers concerned. Or again, where problems are not adapted to university research as being special to a particular industry, special manufacturers' researchers are employed. Manufacturers also are invited to inform universities of problems not of sufficient importance to the industry to study directly, but which the universities may employ as practical objects of research by students. It is evidently realised that the industry alone is able to bring forward its problems and to finance investigations of such by one or more of the universities; and industries must, it is held, be prepared to devote time and money to training researchers for their own investigation work, given the fundamental university training. Manufacturers' associations in the United States have adopted in great measure Professor Duncan's scheme of industrial research scholarships at universities or technical colleges, which 10 years' experience has proved successful. The foregoing is only one indication of activities in other countries which connote a more strenuous international industrial competition directed by scientific organisation and experience in such a way as the world has never before witnessed.

Let us turn from this to see how we in the British chemical industry stand. I am assured on every hand by those who ought to know from long experience and daily contact with the facts that there is probably no such disorganised industry as the chemical. For this there are several reasons assigned, apart from the diversity of manufacture, and also the jealousy and fear of disclosure of secret manufacturing processes. First, there is the small scale of most chemical businesses in this country, which renders it impossible for any small firm to finance or organise research in an effective manner. "The small manufacturer cannot risk the initial failures which researchers must expect to encounter, and he cannot afford to wait long for the return in capital. Again, labour and political uncertainties, due to party needs, enforce short views. The Paper Manufacturers' Association of Great Britain and Ireland have recently pointed out to the Advisory Committee on Commercial Intelligence of the Board of Trade that the paper-maker wishing to call to his aid scientific investigation on new lines of research must personally bear the whole burden of the high fees of the scientific expert, and gets usually in return only one investigator's skill and knowledge. The remedy proposed was a central institute like the Charlottenburg Materialprüfungsamt. Then, again, as the Privy Council Committee point out in their last report, the conversion of businesses into limited liability concerns places control in the hands of salaried managers usually with too narrow an outlook, and who are apt to resist proposals for improvement. They fail to grasp the fact that research is an investment, not a speculation. Again, there are very legitimate doubts as to after-the-war security for expenditure in research with a view to improvements and developments, and this raises the tariff question. Protection alone will not suffice unless associated with combination and organisation, and Government aid, financial

and otherwise. The Privy Council Committee consider that essential industries relatively small in size—especially if key, pivotal, or master—require special State protection, and they cite among others as chemical examples, chemical glass and porcelain, fine chemicals, dyes, synthetic drugs, and high explosives. These are considered essential to the national well-being, and consequently demand special State assistance.

Now I may go on to outline shortly the ambit of this new Association's activities. In the first place, perhaps some very short account of the evolution of the Association may not be out of place. The Association of British Chemical Manufacturers arose out of a joint meeting of the Councils of the Chemical Society, the Society of Chemical Industry, and the Society of Dyers and Colourists held on the 4th of November, 1915, to consider the best methods both for promoting co-operation amongst chemical manufacturers themselves, and between them and the teachers in universities, colleges, and technical schools, and for the initiation and prosecution of researches in connection with the chemical industry. A joint committee of nine, comprising the three presidents and other six eminent chemists, was thereafter appointed to consider the points raised, and to report. They recommended that in view of the vital need for organisation among this component parts of the chemical industry, the three societies should invite representatives of the various branches to meet in conference for the purpose of establishing such organisation. They recommended further that an association of British firms engaged in chemical manufacture should be formed. In response to this invitation, representatives of over 100 firms engaged in the chemical industries assembled at a meeting in Burlington House last May and resolved that "It is desirable that British firms engaged in chemical and allied trades should form an association to promote closer co-operation and to place before the Government the views of the chemical trades generally, to further industrial research, and to facilitate closer co-operation between the chemical manufacturers and the various universities and technical schools." The recent report of the Committee of the Privy Council for science and industrial research (1915-16) says, "It is clear, we think, from these examples that we may expect in growing measure to have the help and sympathy of the manufacturers in the work that lies ahead. It is natural that those who have felt the fires of adversity should be the first to welcome the new movement, but there is growing evidence that many of the most enlightened firms engaged in prosperous industries are alive to the need of long views. The engineering trades have always been able to hold their own, yet they had become convinced before the war that association was necessary, especially in the markets of China and Russia, if they were to compete successfully with Germany." They intend to include the prosecution of research among their activities throughout the country, as mentioned in the Privy Council Committee's report.

Now to return to the Chemical Manufacturers' Association, the objects of the Association are stated in the Articles of Association to be (1) to promote co-operation between British subjects engaged as manufacturers in the chemical or closely allied industries; (2) to place before Government and Government officials and others either in the British dominions or elsewhere the views of members of the Association and others upon matters affecting the chemical industries; (3) to develop technical organisation, to promote industrial research, industrial efficiency, and the advancement of applied chemistry; (4) to keep in touch with the progress made in chemical knowledge and practice, and to facilitate the develop-

ment of new British industries and the extension of existing ones; (5) to improve the methods of education in chemistry and its allied subjects so that the methods shall be better adapted to the practical necessities of the chemical industry, and to encourage the sympathetic association of members of the Association and others engaged in the chemical industry with the various universities and technical colleges, either in the British Dominions or elsewhere, and to arrange conferences between manufacturers and teachers; (6) to found, manage, and control a journal or journals for the purpose of making known and advancing the objects of the Association; (7) to supervise and finance researches undertaken in the interest of the chemical industry, and to raise special funds for this and other purposes by voluntary contribution; (8) to found scholarships or lectureships, and to give prizes or in other ways to subsidise or support by subscriptions, donations, or otherwise, universities, colleges, schools, and institutions for the promotion of objects similar to those of the Association in any part of the British Dominions; (9) to obtain any Royal Charter, Provisional Order, or Act of Parliament, or other authority, either in the British Dominions or elsewhere, for enabling the Association to carry any of its objects into effect, and to institute, promote, support, or oppose legislative or other measures or proceedings affecting the interests of the chemical industry, and generally to consider questions concerning it; (10) to act as arbitrator or to appoint arbitrators to act in the settlement of disputes arising out of transactions in or relating to the chemical industry; (11) to affiliate with any other organised body or bodies in the British Dominions having objects similar to those of the Association; (12) to further the objects herein contained or any of them by acting directly or indirectly through (or by promoting co-operation between, or co-operating with) any other organised body or bodies whatsoever in any part of the British Dominions and by appointing members of the Association and others to represent the Association or any such body or bodies; (13) to promote, found, support, or finance any other company or other organised body in any part of the British Dominions for the furtherance of the objects herein contained or any of them; (14) to purchase, take on lease, hire or otherwise acquire for the purposes of the Association, or as an investment of its funds any real or personal property, and to maintain, improve, and develop and dispose of the same; (15) to borrow money, within the limit fixed from time to time by the members, for the purposes of the Association; and, lastly, to do all other lawful things incidental or conducive to the attainment of the above objects of the Association.

The Association is at present being registered under the Companies' Act as a company limited by guarantee and not having capital divided into shares. The qualification for membership is carrying on business as manufacturers in the chemical or closely allied industries either as corporations or individuals or in co-partnership as a British firm.

Then, as regards definitions in connection with the qualification of members of a British Corporation, a British Corporation is a body which in fact and in spirit fulfils the following conditions:—It must be incorporated by Royal Charter of the Crown of the United Kingdom or by, under, or in pursuance of the laws of some part of the British Dominions. A preponderating majority in number and influence of the governing body must be British individuals. It must be mainly controlled in and from some place within the British Dominions. A preponderance of the share-capital and also of the loan-capital, if any, so far as can be ascertained, must be held and owned by British individuals or corporations.

A British firm is an unincorporated body which in fact and in spirit fulfils the following conditions:—A preponderating majority in number and influence of the partners must be British individuals or corporations. It must be mainly controlled in and from some part of the British Dominions. A preponderance of the share-capital and also of the loan-capital, if any, must be held and owned by British individuals or corporations. A "British individual" is a British subject who is habitually resident within the limits of the British Dominions.

Subscriptions to the Association vary with the amount of capital (if share-capital, the amount paid up or issued as paid up), including loan-capital, if any, declared by the member or his firm as to be used in chemical or closely allied industries. The amount varies from 25 guineas as a minimum up to 250 guineas as a maximum, according to capitalisation.

As regards management, the Association will be managed by a council of not more than 20 members, 16 elected members, and 4 co-opted. The elected members must be members of the Association or a director, manager, or other prominent official of a Corporation, being a member of the Association. The co-opted members must be British subjects, and each must be a member of the governing body or an officer of a corporation or institution connected with the chemical or closely allied industries, or any other fit and proper person being a British subject.

In addition to the council—the principle underlying whose selection will be personal fitness for office, and not merely representation of firms or corporations, however rich and considerable (that is a very important point)—the various branches of the chemical industry have been grouped tentatively into 10 sections. Each will elect members of a representative committee, and matters on which they desire the council to take action would be laid before the council by the Chairman of the committee or possibly by other representative selected by the particular committee. It is quite impracticable in such an industry as the chemical to have representation of each branch of chemical industry on the council, as the effect of this would be to make its dimensions so unwieldy that it would be impossible to transact rapidly and efficiently the Association's business. Ample opportunity will be afforded for representations from any particular branch, however small, in or out of London, to be made direct to the council, either through the committee-chairman or, in special cases, such special representative as may desire to place the case of his own business before the council. It is certain not infrequently to happen that recommendations and requests for action will be put forward by members representing one particular line of business which are perhaps diametrically opposed to the interests of other firms connected with the Association. In such cases there must be negotiations between the representatives of the opposing interests, and the council would then have to support with all its resources and influence, the proposals which are in the interests of the Association as a whole. We must look to a spirit of conciliation and broad-mindedness, of give-and-take, in the settlement of such differences which must always be expected to occur in business relations. As regards the sections or groups of industries, a member may, at any time, elect to be classed as belonging to one or other group, and of course where a number of different chemicals are manufactured by the same firm or individual, there would be membership of such groups as included the articles manufactured. Group committees are to consist of not less than three members, and each elects its own chairman. I may point out that the Privy Council Committee stated in their most recent report that, "it seems

unlikely that a single chemical committee with the large number of special sections that would be necessary can usefully be established at the present moment, and we are disposed to think that a series of standing committees dealing with particular branches of chemical trades may be a better method of proceeding." The council of the Association had previously arrived independently at the same conclusion, and it is difficult to see what possible alternative there can be. It is most important that as soon as possible these group committees should get to work and state the problems, in order of urgency, with which the Association is required to deal. This opinion is reinforced by the Privy Council Committee who express the belief that the "shortest means" to convince the manufacturing world in general that scientific research is a paying proposition is to attack the pressing problems of manufacture which arise in course of the ordinary routine—problems which no doubt the manufacturers "ought to solve by means of their own scientific staffs, but which their present staffs are too small to undertake, often because the firms are too small to bear the cost. It was in this way that the universities of the Middle States of America convinced the farmers that science was useful to agriculture."

There are a number of other points which I may very briefly touch upon. The benefit accruing from the discussion together of problems is found to be mutually advantageous in similar and allied branches of the industry. Experience shows that very clearly. Hitherto, fears regarding trade secrets, processes, etc., have prevented this, but the balance on the whole in a give-and-take policy is found to be satisfactory. Mutual co-operation will prevent overlapping of effort, duplication of researches and of plant, and also to ensure effective dealing with general problems of the most varied kind. Problems necessitating research undertaken for chemical industry as a whole, as you have seen, should be dealt with by sectional committees in the first place.

As regards the after-the-war position, problems will arise with regard to the utilisation of munitions' plant, equipment and works, and works' staffs, including chemists, to the best private and national advantage, and it is very easy to see that this can only be worked on a co-operative basis. To assist new industries and to increase enormously the productivity of essential industries like dyes, fertilisers, nitrates, etc., are also points which will require special attention. Co-ordinated action regarding legislation affecting industry is another most important point. Parliament will help those who know how to help themselves. Then again as regards Patent Law Reform—much of our failure in certain branches of industry has been due to our Patent Laws having helped the foreign, especially German, patentees. Lawyers in and out of the House of Commons have often been the best friends of large German chemical concerns. Everything has been done to help them, to the detriment of home industries, especially chemical, which are usually process patents, as against engineering and mechanical, which are products patents, and ought to be dealt with on different legislative lines.

Of course there is the great educational question which demands close co-operation between universities, technical institutes, and manufacturers. The co-opting of suitable experienced manufacturers on certain university committees appears to be requisite and this in some quarters already obtains to some extent. But usually the details are badly worked out, or badly managed. Pure research must, I fancy we all agree, always be the function of the universities and technical institutes, though of course we all know the difficulty of drawing a line between

pure and applied science, which merge into each other at many points.

Individual manufacturers must clearly abandon the idea that other manufacturers are rivals to be fought. All must combine against the German manufacturers, whose chief strength in the past has been due to splendid organisation, largely carried out by a powerful society in close touch with chemical manufacturers on the one hand and State Departments of trade and industry on the other, which have helped in every way to further home and foreign exploitation. I believe the name of this society is the Society for the Promotion of the Interests of the German Chemical Industries.

Effective research needs continuity of time and effort. Hence usually it is only possible for combines to finance it. Trade associations, formed originally to fix prices, regulate production, or deal with labour questions, are now turning to co-operative and scientific inquiry to relieve them from difficulties created by foreign monopolies of manufacture.

I understand that there exists a widespread misunderstanding that this new Association is in the nature chiefly of a combine for mutual protection and development of the interests of the largest chemical manufacturers in the country. I may at once deny this in the most emphatic manner. It is intended to protect and promote the interests of the very smallest manufacturers equally with those of the millionaire businesses. So far from there being the slightest basis for this erroneous belief, it may be pointed out that the council is composed of representatives of small, as well as large businesses, and that the decision to man the council by the best available brains and not by the loudest purses, is a sufficient guarantee of the protection and assistance which will be offered to all alike, for isolated they will fall, while united they will stand and flourish. Indeed, the small manufacturer will certainly receive an amount of help from collective investigations, and political and other action, disproportionately great to his contribution to the common funds. In this organisation, while each firm will retain its special entity, combination will allow of all participating in the advantages of such combination. I repeat that this Association mainly exists in order to bring the largest and the smallest firms together to settle how best to secure future progress and obtain the needful help and legislation for the interests of our industry.

When I was appointed recently to the General Secretaryship of the Association, I ventured to send our Chairman some notes which were hurriedly put together, but which on looking over again, I thought might be usefully brought before your notice to-night. It will be understood that these views are purely personal. The first point I noted was the question of sectional treatment of the industry, and the means for bringing the sections into active co-operation at once. I think that is a most pressing need at the present moment. Then again I proposed that we should have a Political Committee, first of all to organise a public propaganda regarding the necessity for Government assistance and concessions, fiscal and otherwise, for chemical industries. I feel exceedingly strongly on this question, personally, as the result of some experience of Government Departments and their often curious ways. As regards the Cabinet Minister, he is not likely to take much interest in any subject unless he realises that there is a strong, well-organised body of public opinion behind the proposals. Then, again, the Political Committee would have to consider questions of possible Patent Law modifications. It will have to deal with the thorny question of tariffs. It will have to affiliate or combine with other manufacturers' organisations to secure further political

action, for instance, with the Associations of engineers, iron and steel, textiles, electrical, shipping industries, etc. Then again, Parliamentary action will have to be co-ordinated with regard to giving effect to the above. And, further, such a Committee would have to keep a very watchful eye on commercial treaties; and questions relating to commercial intelligence require very close attention. I think I am correct in saying that this is a subject with which the Society of Chemical Industry has concerned itself very actively of late, and we hope to co-operate with the Society in pressing forward action in the matter. Commercial intelligence, of course, is a very difficult question, and a well devised scheme to secure such is costly beyond the resources of any Association. We must look for State aid to some extent, but there is a limit to what we can demand in the matter of State aid. There are certain special lines concerning which special commercial intelligence is required, which, I think, properly fall within the ambit of a special trade association, and we may have to look forward to financing such special inquiries ourselves. We will have to get as much as we can out of Government generally, but at the same time we must probably face the necessity of ourselves financing special sections of commercial intelligence. Then again, I think we all feel that early action regarding the re-organisation of the Consular services is very urgently required. It was a great pleasure to see Lord Faringdon put this forward as one of the spheres of activity of the new Trade Bank. We will probably have to co-operate in that work, and we must see that as far as possible only trained Britishers are appointed to most posts, and that the service is made possibly a graded service with adequate prospects to attract promising men. That is a matter for negotiation and arrangement, but it is one which, of course, if you are going to maintain a hold on the markets, you will all agree with me is one of paramount importance.

There is also a question which your Society considered so important at its recent meetings that they passed a special resolution concerning it, namely, industrial alcohol. The difficulties and disabilities connected with it are keenly felt by many manufacturers in the chemical industry, and though it will be an exceedingly uphill fight, it is one which I think will, in great measure, be determined by the amount of political pressure we may be able to bring to bear on it. We must look forward to considerable fiscal modifications. There is no reason why this question of industrial alcohol should be treated on the same basis as it would appear to be by at least some heads of Departments, as potable alcohol. I personally hope to see some day industrial alcohol placed on a duty-free basis. Probably we may arrive at that stage by a half-way measure such as a small *ad valorem* tax, but I think it is a perfectly reasonable proposition to expect that industrial alcohol should ultimately win the position of being duty free. Of course, one of the great difficulties with regard to this question is the question of adequate denaturation, but this is merely a matter for further investigation. Then side by side with that there is the matter of cheapening of its production.

I also suggest that we should institute a system of visiting chemical laboratories throughout the United Kingdom which are available for general and special research, and that we should keep a register for our members' use of research chemists with the necessary qualifications, and perhaps have a system of confidential reports from teachers and employers. The question of conjoint researches will have to be dealt with, and we will have to look to some extent for a State subsidy for research, at any rate in the early stages.

I hope we will soon develop Overseas branches of this Association. Again, affiliation with British

chemical societies generally, such as your own, is essential. Then we hope to get into close relationship with the Advisory Councils of the Privy Council Committee, of the Board of Trade and other Government Offices. Further, we must try to have a Bureau of industrial chemical information, apart from research, and to consider the best channel for the dissemination of this information to members. There is also the question of developing laboratory and other arrangements for the use of the smaller manufacturers, that is, those unable to support separate laboratories for themselves. Then again (though at this stage it is perhaps a minor and remote issue), we should look forward to having a Bureau of standards, instruments, physical constants, and dealing with properties of materials, purity of reagents, etc., either to be developed by the Association, or possibly by, or in conjunction with, some Government agency.

Others of our main objects certainly would be the co-ordination and direction of investigations to prevent overlapping; also the training of industrial chemists, and the co-ordination of the work of technical colleges throughout the United Kingdom so as to supply not only chemists but also scientifically trained craftsmen. Another very important point is the avoidance of duplication in the supply of raw materials for chemical industries (for example, in fine chemicals, dyes, and other branches) by allocation of manufactures. We shall have to look forward to mutual arrangements for the manufacture of intermediate and other products to prevent this duplication, and one of the earliest steps will be a census of firms and output capacities. In fact, we must work up to a census of British and Colonial chemical resources generally. We must also closely consider the systematic study of markets, overseas and foreign, and the science of international trading. Syndicates will no doubt in time be developed to control production and sales, and when the home markets are fully supplied to direct products abroad; and broadly we shall all have to bend ourselves to improving the quality of manufacture and reducing the cost of production, to the utilisation of waste materials, and we should consider the trade control (where applicable) of a complete line of production, as for instance, coal, blast furnaces, steel works, tubes, etc. Another very important point is our relationship to transport agencies at home and overseas. And lastly, there is the fuel question, with special reference to the chemical industries.

There are also most important questions relating to trade marks and their protection abroad, financial assistance from Government or (when started) from the new Trade Bank for the development of commercial intelligence with special reference to the needs of the chemical industry; trade exhibitions; the much debated question of a Ministry of Commerce—and I hope that we shall avoid in this country the mistake which was made by Lord Curzon in India when he started his Ministry of Commerce and Industry. When any new Department is proposed by a Government, a wave of pleasant hope and anticipation passes over many of the other Departments. They immediately set to work to try to unload much of their most unpopular and troublesome work on the new Department. Thus the new Ministry's energies are deflected from many spheres of essential usefulness by such re-distribution of Departmental work. Well, one looks forward to a new Ministry independent of party changes, and also independent of the other Departments as far as possible.

Other subjects are, for example, the extension of the system of Trade Commissioners under the Board of Trade or a Ministry of Commerce; questions relating to commercial travellers in the

British Dominions with regard to preferential treatment in respect of licence fees; trade catalogues, and, lastly, tariff protection. Most of these have been very shortly touched on in the recent report of the Advisory Committee to the Board of Trade on commercial intelligence after the war. Each of these headings will have to form the subject of careful inquiry by representatives of chemical manufacturers, and efforts must be made to secure adequate co-operation with representatives of other great industries and scientific and teaching institutions of the country for combined action. All this naturally will take time but we must all be deeply impressed with the great urgency of these matters.

Vigorous action must be taken without further delay to formulate our requirements as chemical manufacturers, and to press forward joint action with other industrial associations. Personally, as previously stated, I strongly hold the view that Government will not move actively in these matters until subjected to very strong political pressure, both in Parliament and in the country, and it is hoped that this will be vigorously pushed forward as soon as we decide what we want and what is the minimum action on each point we require.

I leave the question of the Association for a moment to touch on what we are doing in connection with the British Science Guild. The British Science Guild was founded as most of you know in 1905 with the object of bringing home to all classes the necessity for the scientific treatment of affairs of all kinds, and at the present moment we hope to take very vigorous action with regard to pressing forward the relation of science to industry and education. I may mention perhaps that I am a member of a standing committee of three which has just been appointed by the Guild to conduct an active propaganda throughout the country on this point, and to press our views very strongly on the Government, mainly through political and other agencies.

The war surely has taught us the folly of relying on foreign, possibly enemy, manufacturers for goods which ought with proper foresight and organisation to have been produced at home. The advantages which have enabled the foreigner to undersell the British manufacturer are also ours, if people will now insist on obtaining a proper organisation and also the fiscal and other requirements to enable us successfully to compete. Unless we set vigorously to work to equalise and, as far as possible, to better our competitive conditions and to train a large supply of practical and efficient researchers, and unless we agree to set aside purely selfish aims and heartily to co-operate and co-ordinate with those who were and are our competitors for our mutual advantage, as well as with every agency, labour, manufacturing, educational, and Governmental, the future of chemical industries in this country is, indeed, gloomy. Both self-interest and patriotism require us to combine against our common enemy, the German, rather than waste our energies in home competition. Full discussion of plans and the necessity for cautious advance are, of course, necessitated by the situation, but it seems that the first requirement now is action, and again action. Do not let us be too timid as to launching our measures of reform until they are elaborated to a high pitch of perfection. Every new departure is an experiment more or less, and time is pressing. Let us evolve and readjust as working experience indicates, and not wait too long in the hope of producing an, at best, doubtfully perfect scheme which seems to meet the views of everyone. Compromise in such matters can be carried too far, and may lead to adjusting a scheme out of all working proportions. Let us get to work then without further delay, and push on with the

enormous programme of improvements and reforms which lies ahead of us.

Meanwhile, until we ascertain clearly what the present needs of each chemical manufacturer are, and the plan most likely to put matters on a proper footing, and again until we come together and discuss, as actual manufacturers are alone best qualified to do, the common needs of the industry, it would be a mere speculative and probably useless exercise on my part at present to attempt to forecast the specific action which may be taken, or the decisions which may be arrived at. What I have tried to do is to outline very roughly the machinery which has been prepared in order to deal with the situation and some of the objects in view.

I have not attempted to deal with one of the most difficult and important points—labour—for one feels there is much educative work ahead for both employers and labourers in this matter. Co-operate we must, and that cordially, but sympathy and confidence are essentials to sound development, and will be the result of faithful work and much patience. The interests of employers and labourers in this matter are really identical, but it will take time and patience to bring this home to both groups, though it must be done unless both are to suffer as never before.

Many other points doubtless occur which I have not had time to touch on, but my object is to arouse interest and enlist practical support for the great effort that lies ahead of us in organising the chemical industries of this country. Personally, I view the situation hopefully. A nation which has performed in a short time, comparatively, the prodigies in the way of raising and training an Army—and such an Army!—of millions, and in effecting what we have as regards munitions, not to speak of the wonderful work of our glorious Navy, has no cause to fear its ability also to wrest industrial victory from the German enemy or other rivals. The dangers are complacency and a lapse into the easy, comfortable, pre-war trot. From now onwards such easy ways must be abandoned, and we must be prepared to work and organise as never before in our past history. In order to do so we only require fully to realise the needs, and to obtain efficient direction and adequate protection and stimulation for our efforts. Then we shall again come to occupy the place in the world of industry which is the due of our national qualities.

Sydney Section.

Meeting held at Sydney on Wednesday, 19th July, 1916.

MR. H. G. SMITH IN THE CHAIR.

A CAUSE OF MUSTINESS IN BREAD.

BY A. M. WRIGHT.

During 1915 the author was engaged by a firm of bakers to examine some flour, which, it was alleged, had been the cause of mustiness in the bread baked from it. For the purposes of the investigation six samples of flour were taken; and of these, two, which liquefied nutrient gelatin in 48 hours at 20° C., were examined bacteriologically by Dr. A. B. Pearson, Pathologist to the Christchurch Hospital Board, who drew fresh samples under strictly aseptic conditions; as a result of his investigations, he reported that in

the flours represented by the two samples noted above as doubtful, prolific growths of both *Rhizopus nigricans* and an *Aspergillus*, probably *glaucus*, were present. Subsequently pure cultures of the *Rhizopus nigricans* and of the *Aspergillus* were handed to the author for further investigation and the results recorded in this paper were obtained.

The samples of flour drawn by Dr. Pearson contained 10.6 and 11.1% moisture and were thus quite normal in this respect; further the samples were not caked, and in no way showed evidence of having been at any time in a moist condition. Portions of the flour containing the prolific growths of *Rhizopus nigricans* and *Aspergillus* were made into bread by independent bakers, and all such bread was found to be musty and unpalatable.

Laboratory experiments were carried out as follows:—1. Sound palatable bread was sterilised, and then mixed with an extract from the *Rhizopus nigricans* and the *Aspergillus* cultures, filtered through C. S. and S. hardened paper. 2. Sound palatable bread was sterilised and mixed with a fluid extract of the *Rhizopus nigricans* and of the *Aspergillus* cultures. 3. A check with the sterilised bread was carried out.

All were incubated at 37° C. for 24 hours, and it was then found in the results from (1) that the *Rhizopus nigricans* extract produced a marked mustiness, and slight sourness, in the odour and flavour of the bread; with the *Aspergillus* extract the bread was very sour in odour and flavour. From (2) similar results were obtained, with the addition that growths of *Rhizopus nigricans* and *Aspergillus* appeared in the dishes treated respectively with *Rhizopus* and *Aspergillus*. In (3) neither mustiness nor sourness developed in the bread; it was therefore concluded that *Rhizopus nigricans* is capable of producing mustiness in bread, while *Aspergillus* is merely productive of souring.

Subsequently experiments were carried out in order to determine what enzymes were present in the *Rhizopus* and the *Aspergillus*, which might be responsible for the results noted. An extract of each culture was prepared by mixing the cultures with sand and triturating the mass with water; after filtering the solution through absorbent cotton, the filtrate was used for the demonstration of enzymes. The methods used were mainly those described in some detail by Houghton,* the following enzymes being tested for in each filtrate:—lipase, invertase, diastase, catalase, and proteolytic enzymes. In the case of the *Rhizopus* extract, lipase, catalase, and a proteolytic enzyme were found; in the *Aspergillus* extract, there were found lipase and invertase; in neither extract could diastase be demonstrated. A. Percy Smith† has shown that *Mucor mucedo* is a responsible agent in the production of musty bread, and has noted that putrefaction of the affected bread is also associated with mustiness. In the case under review no putrefaction of the bread was found in the sense at least that it became foul and putrid in odour

even after fourteen days; the bread certainly was unpalatable. The *Rhizopus nigricans* extract when mixed with gluten produced after 24 hours at 37° C. an odour similar to musty bread, but no putrid odour could be noted.

From a consideration of the data presented above it appears clear that *Rhizopus nigricans* is a cause of mustiness in bread, and that the proteolytic enzyme present in this organism probably brings about the changes in the bread which are associated with the odour and flavour noted as mustiness.

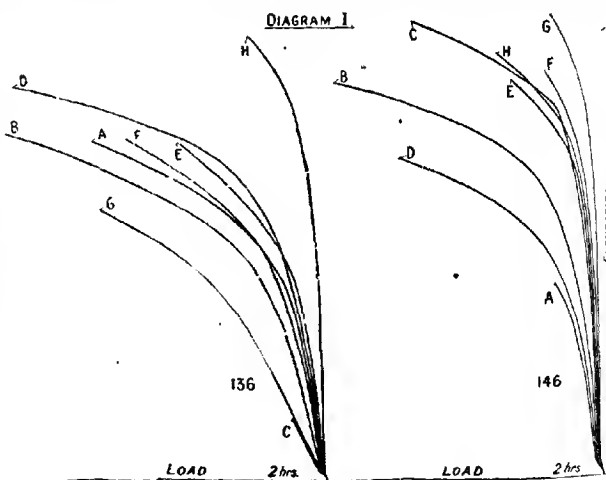
Communication.

VARIABILITY OF PLANTATION PARA RUBBER WITH DIFFERENT TECHNICAL MIXINGS.

BY B. J. EATON, F.I.C., AND J. GRANTHAM, B.A.

Chemical Laboratory, Agricultural Department, Federated Malay States.

The question of the variability of plantation Para rubber, when vulcanised with various technical mixings in addition to sulphur, has been raised by Stevens in a discussion on a paper recently submitted to this Society by G. Stafford Whitby, entitled "A Comparison of the Brazilian and Plantation Methods of Preparing Rubber" (this J., 1916, 35, 493). Stevens says: "There was too great a tendency to limit tests to what was really a very theoretical mixing, consisting of rubber with perhaps 8% to 10% of sulphur added to it. Such a mixing was very seldom used in manufacturing work, and it was assumed, without

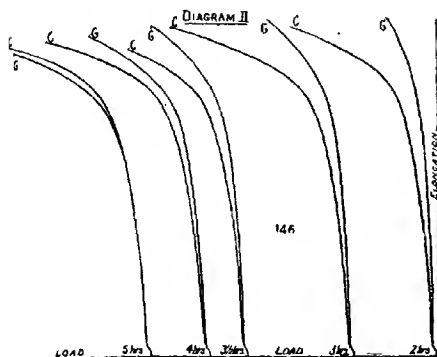


experimental proof, that what applied to a theoretical mixing of this description also applied in the same manner and degree to the great variety of technical mixings which were used in a rubber factory." (N.B.—In Whitby's experiments, in which the vulcanisation tests were carried out by Schidrowitz, 100 parts of rubber to 8 parts of sulphur was used; in our researches 90 parts of rubber to 10 parts of sulphur was employed in all the experiments so far published.)

* Journal Ind. Eng. Chem., 3, 505.

† Analyst, 10, 181—183.

In the experiments described here, we hope to show that what applies to a theoretical mixing (as Stevens describes an 8% or 10% sulphur mixing) also applies to smaller proportions of sulphur in rubber mixings and also to mixings containing, in addition to sulphur, mineral substances such as oxide of zinc and oxide of magnesium, a result which would be expected from the nature of the vulcanisation process. That a "theoretical" mixing of 8% or 10% of sulphur would apply in the same manner or to the same



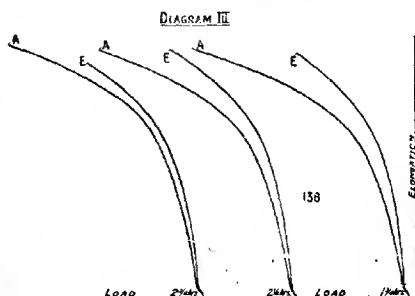
degree to rubber mixings containing mineral ingredients, etc., has not, so far as we are aware, been assumed, nor is it probable that it would do so, although the differences in rate of cure, which Schidrowitz and Goldsbrough and independently our own researches have shown to be marked in the case of plantation Para rubber (due to methods of coagulation and preparation), still exist, whatever mixing be employed, provided such mixings do not contain powerful accelerators such as oxide of lead, which, as would be expected in view of the theory put forward by us as to the cause of variability in rate of cure, would obscure the issue.

Experimental.

For details of technique, reference should be made to our first Communication, "Vulcanisation Experiments on Plantation Para Rubber.—The Cause of Variability" (this J., 1915, 34, 989).

used as the control after adjusting to correspond with the temperature of 140° C.)

The samples were vulcanised in moulds, as described in the paper to which reference is made. All tests are carried out on the third day after vulcanisation, a point we omitted to mention in a previous communication. The tests were carried out on the Schopper-Dalen rubber testing machine, with ring specimens, using the autographic apparatus to register the load-stretch curves, which illustrate differences in rate of cure more satisfactorily than numerical results.



In each case the same mixing was used on a fast curing and a slow curing rubber, i.e., rubbers which, under the usual conditions employed by us, are fast and slow curing, and which represent the extreme limits of cure met with in the case of rubber coagulated with approximately the minimum quantity of acetic acid, viz., about 3 oz. of a 5% solution per gallon of latex diluted to contain 1½ lb. of dry rubber per gallon. Portions of the same fast and slow curing rubbers were used for all the different mixings. The fast and slow curing rubbers were also derived from the same latex, the differences in rate of cure being due entirely to the method of preparation.

The fast curing rubber was prepared by allowing the coagulum, after lightly pressing, to remain in this form for at least six days before washing and crepeing, and the slow curing rubber by crepeing the coagulum a few hours after coagulation. (Vide previous researches by us).*

The following table gives the mixings employed:—

	Actual quantities (grms.).					Percentage on total mix.				
	Rubber.	S.	ZnO.	MgO.	PbO.	Rubber.	S.	ZnO.	MgO.	PbO.
136 A & E	240	12	148			60	3	37		
" B & F	240	12	140			60	3	35		
" C & G	200	16	160		40	48	3.8	38.5		9.6
" D & H	400	20				93	7			
158 A & E	300	15	180			60.6	3	36.3		
" B & F	300	15	160			60.6	3	32.3		
" C & G	300	15	140		40	60.6	3	32.2		8.1
" D & H	300	15	160		20	60.6	3	32.3		4.0
146 A & E	450	50				90	10			
" B & F	400	30				93	7			
" C & G	500	25				95.2	4.8			
" D & H	500	50				90.9	9.1			

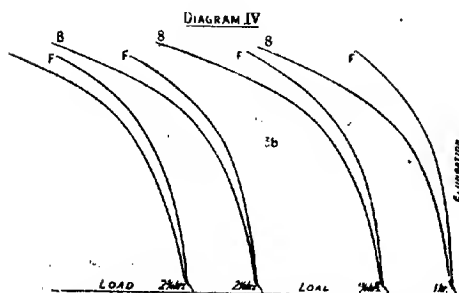
The mineral additions were added in a similar manner to the sulphur, and the vulcanisation was carried out as in our previous experiments in a double jacketed steam autoclave at 140° C. (N.B.—The temperature is controlled both by a thermometer and pressure gauge, as it was found that the latter reacted immediately to any change of steam pressure, while the thermometer took an appreciable time to register a slight change of steam pressure; the steam gauge was therefore

In the above tables samples A, B, C, and D are the fast curing rubber, and samples E, F, G, and H the slow curing rubber. As will be seen the mixing usually employed in our previous experiments and on which the differences in rates of cure have been based hitherto, is that used in 146 A & E.

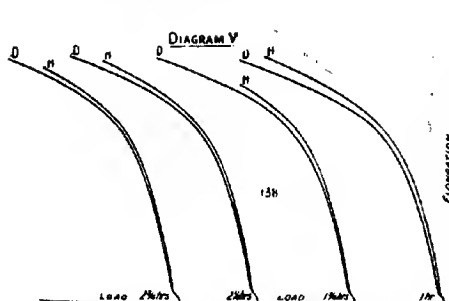
The results of the vulcanisation tests are given in the tables below and in the diagrams of the load-stretch curves, which explain themselves.

*This J., 1916, 30, 715—728.

It will be seen that some of the figures are somewhat erratic, as would be expected when only two rings at each cure are tested, since rubber loaded with mineral mixings does not break as regularly as mixings containing only sulphur and rubber. The curves however are of much more importance



in illustrating the differences in rate of cure between the samples, and show conclusively that the differences obtained in this respect between the rubbers, when using what Stevens terms "theoretical mixings," are still maintained when various technical mixings are employed, although, as would be expected, the type of rubber obtained is very different. The differences in type for different technical mixings and also for different sulphur and rubber mixings are well illustrated by the curves given in Diagram I for all the samples 136 and 146 cured for 2 hours, in which it will be observed that the curves for the different mixings are not parallel beyond the point of inflexion.



In order to show the effect of the period of vulcanisation on the figures for tensile strength and elongation, the results obtained at all the different times of cure adopted are included in the following table:—

Ref. No.	Time of cure.	Breaking load. (Kilos. per sq. mm.)	Elongation at break. (Original length=100.)	Product.
	Hours.	(a)	(b)	(a x b)
136 A ..	1	1.30	938	1219
	1½	1.36	916	1245
	2	1.27	909	1143
	2½	1.33	914	1215
136 E ..	1	1.22	890	1085
	1½	0.61	935	570
	2	0.87	927	806
	3½	1.00	913	913
136 B ..	1	1.57	833	1404
	1½	1.61	910	1465
	1½	1.38	888	1225
	2	1.54	912	1404

Ref. No.	Time of cure.	Breaking load. (Kilos. per sq. mm.)	Elongation at break. (Original length=100.)	Product.
	Hours.	(a)	(b)	(a x b)
136 F ..	1½	0.81	905	733
	2	1.01	895	903
	2½	0.90	848	763
	1	1.43	759	1085
136 C ..	1½	1.31	761	996
	2	0.88	675	594
	1	1.22	741	904
	1½	1.23	759	933
136 G ..	1½	1.08	709	765
	2	1.12	731	818
	2½	0.87	647	562
	1	1.04	1024	1064
136 D ..	1½	1.22	1070	1305
	1½	1.41	1053	1484
	2	1.42	1018	1445
	2½	1.44	1005	1447
136 H ..	2	0.39	1137	443
	3½	0.90	1079	971
	3½	0.99	1043	1042
	1	1.33	931	1238
138 A ..	1½	1.49	930	1385
	2	1.44	917	1320
	2½	1.46	923	1347
	1½	0.79	901	711
138 E ..	2½	0.87	910	791
	2½	0.80	863	690
	1	1.35	871	1175
	1½	1.54	895	1378
138 B ..	2½	1.49	892	1329
	2½	1.39	870	1206
	1	0.73	874	638
	1½	0.95	871	827
138 F ..	2½	0.97	873	846
	2½	1.15	986	1133
	1	1.43	818	1169
	1½	1.25	844	1055
138 C ..	2½	1.27	870	1104
	2½	1.28	878	1106
	1	1.45	861	1248
	1½	1.30	873	1134
138 G ..	2½	1.14	858	978
	2½	1.25	892	1115
	1	1.52	863	1311
	1½	1.36	885	1203
138 D ..	2½	1.31	882	1155
	2½	1.15	875	1006
	1	1.27	878	1115
	1½	1.16	886	1027
138 H ..	2½	1.09	874	952
	2½	0.94	844	793
	1	1.18	1052	1241
	1½	1.41	1007	1419
146 A ..	1½	1.57	938	1470
	1½	1.46	920	1343
	2	0.33	588	194
	2	0.54	1043	563
146 E ..	2½	1.17	1036	1212
	3	1.17	1010	1181
	3	1.20	996	1195
	3½	1.23	958	1178
146 B ..	4	0.26	560	145
	1½	1.44	1081	1556
	2	1.50	1039	1558
	2½	1.35	1007	1359
146 F ..	2½	1.31	981	1285
	2½	1.29	957	1231
	2	0.37	1070	395
	3	0.81	1093	818
146 C ..	3½	0.88	1068	937
	3½	0.93	1065	990
	4	1.13	1034	1168
	5	1.22	956	1166
146 G ..	2½	1.05	1166	1226
	2½	1.02	1154	1177
	2½	1.28	1161	1486
	3	1.33	1157	1538
146 D ..	3½	1.28	1142	1461
	3½	1.33	1104	1468
	4	1.28	1140	1459
	5	1.26	1150	1449
146 E ..	2	0.35	1199	419
	3	0.63	1186	747
	3½	0.70	1164	814
	4	0.88	1144	1006
146 F ..	5	1.08	1099	1186
	1	1.16	1088	1262
	1½	1.27	1031	1309
	1½	1.50	1006	1509
146 G ..	1½	1.53	972	1487
	2	1.21	874	1057
	2	0.62	1007	624
	3	1.05	1037	1088
146 H ..	3½	1.12	1021	1143
	3½	1.17	994	1162
	4	1.39	951	1321

It will be seen practically throughout the tables, whatever mixing is used, that the tensile properties of the slow curing rubber are decidedly inferior to the fast curing rubber. This agrees with our previous results on the mixing usually employed. In the fast curing rubber with the mineral mixings (except those containing oxide of

lower times of cure considerable differences exist in the load-stretch curves, if the cure be carried on sufficiently long, the slower curing rubber eventually overtakes the rapid curing rubber, since with low sulphur content, the latter does not change appreciably after a certain period of vulcanisation, even if the cure is carried

further, so that, if these rubbers had been cured for a prolonged period, say 5 hours in the case of samples 146 C & G, the load-stretch curves would have coincided, and the only difference between the samples would have been the inferior tensile properties of the slower curing rubber. Although the difference in rates of cure would thus have been obscured, nevertheless it would still have existed between these rubbers. The comparatively small change in the curves for the fast curing rubber 146 C is shown in Diagram VI, while in the same diagram the slow curing rubber 146 G has altered considerably over the same range.

This point appears to be of importance in connection with the so-called "heat" test for rubbers of this quality, that is, rubbers containing mineral mixings and having a comparatively small proportion of sulphur.

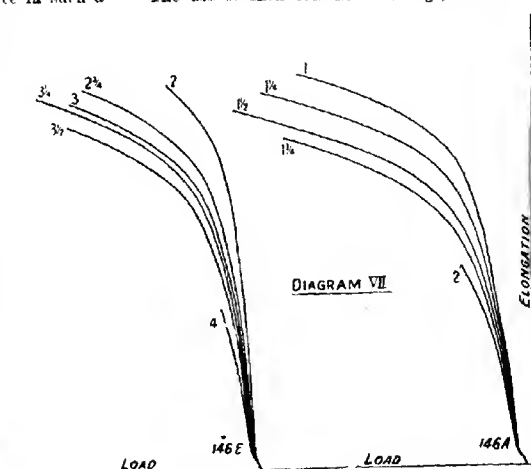
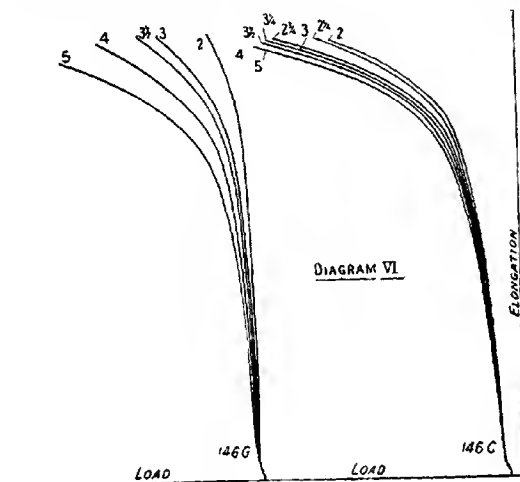
Thus, assuming samples 146 C & G had both been manufactured under identical conditions as to period of cure and temperature, say 3 hours at 140° C., and the "heat" test had been applied to sample 146 C, little or no change would have taken place in this sample, whereas in the case of sample 146 G the rubber would have continued to cure.

The use of such technical mixings, with low

lead) and in the rubber-sulphur mixing containing 5% of sulphur reckoned on the rubber (Ref. No. 146 C), it will be seen that the figures for breaking load and elongation remain constant over a considerable range. This is obviously what one would expect, owing to the small amount of sulphur employed, since, after a certain period of cure, little or no further change takes place in such a rubber, on account of the relatively small proportion of free sulphur remaining in the rubber, compared with a sample containing say 10% of sulphur.

This slowing up of the cure is shown very clearly in the load-stretch curves given, *e.g.*, the curves in Diagrams II and VI for 146 C & G, showing the progression of the cure with time. In these mixings there is not sufficient sulphur to give the very marked and obvious over-cures obtained even in $\frac{1}{2}$ hour at a similar vulcanising temperature (140° C.) when 10% of sulphur is employed. Secondly, an additional $\frac{1}{2}$ hour cure, with these low sulphur contents, produces very small differences in the load-stretch curves and greater time intervals must be used to illustrate the differences due to period of cure for any particular sample. This again would be expected, in view of the mass action of sulphur. The greater change in the curve over a smaller range of time when using 10% of sulphur is shown in Diagram VII for samples 146 A & E.

If reference is made to Diagrams II, III, IV, and V the comparative curves of samples 146 C & G, and samples 138 A & E, B & F, D & H at different times of cure, it will be seen that, while at the



sulphur content, and especially mixings containing oxide of lead, which are largely used for experimental work in America, is possibly responsible for the obscuring of variability in speed of vulcanisation in previous researches, and for the adoption of standard times and temperatures in such work, and many differences in tensile properties of

vulcanised rubbers may have been due to incorrect curing rather than real differences in inherent tensile strength, etc.

In the case of the samples containing oxide of lead, as will be seen, especially from the curves in Diagram V for sample 138 D & H, the differences in rate of cure are largely obscured. This is intensified in samples 138 C & G containing a higher content of lead oxide, the curves of which are not given. This again might have been anticipated, *i.e.*, the addition of a powerful accelerating agent such as oxide of lead obscuring the effect of a natural accelerator present in the raw rubber. We have also been able to show this to be the case when fast and slow curing rubbers are soaked in alkalis, *e.g.*, caustic soda or potash (*vide* Agricultural Bulletin, F.M.S., Vol. iv., No. 6, March, 1916), and also when small proportions (about 1%) of various organic nitrogenous accelerating agents, *e.g.*, piperidine, hydrobenzamide, benzylamine, and *p*-nitrosodiphenylamine are added to rubber-sulphur mixings. (These results have not yet been published by us.) (N.B.—The alkali treatment is not recommended for manufacturing purposes, but is of some scientific interest.) The effect on type of rubber, of substituting equivalent amounts of magnesium oxide and lead oxide for zinc oxide, is shown in Diagrams III, IV, and V. There is a small difference, however, between the fast and slow curing samples even with lead oxide mixings, as will be seen from the curves, especially at the lowest times of cure given, while at the longer cures, the curves approach each other more closely.

The flat nature of the load-stretch curves for the lead-oxide mixings may be noted, showing a tough and hard but not very elastic rubber. Another feature which may be observed is the variation in type with different percentages of sulphur (Diagram I, Ref. No. 146 A—H), the curves actually crossing each other. With low sulphur content (4.8 and 7.0%) much greater elongation for similar loads is obtained than with the 10% sulphur mixing.

We should like here to refer also to the question of the stability of these samples, in view of the fact that no tests have been published by us so far, after the vulcanised samples have been kept for, say, 6 months or a year before testing. Experiments have been carried out, but so far no results have been published. These experiments show that, with the 10% sulphur mixing employed by us, the rubber continues to vulcanise slowly during six months and the extra vulcanisation which has taken place, in all samples so far tested, represents about a quarter-hour cure at 140° C., *i.e.*, the load-stretch curve of a sample vulcanised for say, 1 hour, when tested after six months would coincide with the load-stretch curve for a 1½ hour cure tested 3 days after vulcanisation. A certain amount of deterioration in tensile properties had also taken place. It can be stated here, however, that, while the 10% mixing is an excellent mixing for the purpose in view, *viz.*, to ascertain variations in rate of vulcanisation between different rubbers, especially when it is required to test the samples shortly after vulcanisation, it is, in our opinion, not a good mixing for testing the keeping or ageing properties of different rubbers after vulcanisation, since there is a large amount of free sulphur remaining in the rubber, which gradually exudes and leaves the sample porous and liable to rapid oxidation.

Since, however, the stability of the vulcanised rubber depends largely on whether it has been properly vulcanised, as well as on the nature of the raw material, the rate of vulcanisation must be of great importance, and the failure of many samples of plantation rubber, especially first grade

samples, to keep after vulcanisation, may probably be attributed to the samples not having been properly vulcanised.

Another point which may be discussed here is the use of the term "optimum" cure. Stevens, in a written criticism in the same paper to which reference has been made, says: "It may be stated with confidence that the samples vulcanised by Eaton and Grantham at their 'optimum cure' are much overcured." In this respect Stevens may be perfectly correct, and we have pointed out already in private correspondence, that the testing of rubber from the point of view of its curing capacity is entirely relative and not absolute, and that our "optimum" cure may not be considered by a manufacturer to be the most satisfactory cure. Perhaps a preferable term, and this has also been suggested to us by the chief chemist of a well-known rubber firm, would be "relative rate of cure." We should like, however, to emphasise this by pointing out in reference to our previous results, that if, say, the "optimum" cures of two samples are given by us as 1½ hours and 3½ hours, then, assuming the correct "optimum" for the latter should have been 3 hours, the correct "optimum" of the former should be 1 hour, *i.e.*, each cure is relative to the other.

Conclusions.—The experiments quoted in this paper show definitely:—

- (1) That the variability of plantation Para rubber in respect to rate of cure continues to exist in various technical mixings in which the rubber is loaded with mineral constituents in addition to sulphur, and also in rubber-sulphur mixings containing different proportions of sulphur.
- (2) That the variability is not of the same degree as with mixings containing, say, 8% to 10% sulphur, as would be expected.
- (3) That the use of strong accelerating agents such as oxide of lead tends to obscure these differences which are produced in the raw rubber by the presence of a natural accelerator.
- (4) That other substances, *e.g.*, caustic soda and potash and various organic nitrogenous accelerators, also obscure these differences, since these substances behave in a somewhat similar manner to the natural accelerators present in raw rubber.
- (5) That, for the purpose in view, *viz.*, to illustrate the differences in rate of cure between different rubbers, which we believe to be the most important variability in plantation Para "first latex" rubbers, an 8% or 10% sulphur mixing, without any other addition, is a very satisfactory mixing, even though it may not be suitable for stability or ageing experiments.

Note.—It may be found by comparing some of the numerical results with the curves, that these do not agree at breaking point. In tracing these curves, however, we have always taken the curves which were drawn from the same point for comparison of rates of cure, whereas the maximum breaking strain, which is always given in the tables, may have been obtained with the second ring, used to compare the curves for the same sample at different times of cure. As we have stated before, however, the duplicate curves invariably coincide, except at the breaking point, where one curve may extend further than the other, so that in utilising the curves for comparison of rates of cure, it is immaterial which of the two curves at each cure is used, since an actual flaw, such as an air bubble in the test ring, does not affect the coincidence of the curves in duplicate tests, although it affects the actual tensile strength.

Obituary.

WILLIAM GEMMELL.

A promising career has been cut short by the death of William Gemmell on September 12th, as a result of burns due to an explosion which occurred whilst working at Silloth.

He was born in Glasgow in 1885, and after serving an apprenticeship with Messrs. Tatlock and Thomson he entered the employ of the Corporation Gas Works, Provan, Glasgow. In 1906 he joined the staff of the Metallurgical Department of the National Physical Laboratory and in 1912 was appointed chief chemist to Sir W. G. Armstrong, Whitworth and Co.

He contributed some useful papers to this Society (see this J., 1908, 427; 1913, 581), and was the co-inventor, with O. Smalley, of a patented process for high speed cutting steels.

He was an active member of the Newcastle Section of this Society, having served on the Committee for some time, and had recently been appointed Hon. Treasurer of the Section.

JOHN MACKENZIE.

John Mackenzie was born in 1846. In his early life he was engaged in engineering practice, but early in the "eighties" he became associated with chemical industry, and for about 30 years was connected with Messrs. Sadler and Co., of Middlesbrough. He was the patentee of a number of inventions relating to chemical industry, among which may be mentioned his English Patent No. 6415 of 1909 (this J., 1909, 981) describing the use of fused silica dishes in the cascade system of sulphuric acid concentration. He died in Middlesbrough on September 28th last.

Journal and Patent Literature.

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I.—GENERAL; PLANT; MACHINERY.

Counter-current extraction; Principles of ——. W. K. Lewis. *J. Ind. Eng. Chem.*, 1916, 8, 825—833.

THE principles of counter-current extraction are discussed and formulæ are deduced which show the influence of the size of the extraction system, the amount of extracting agent employed, and the velocity with which the vehicle carrying the substance to be extracted flows past the extracting agent, or *vice versa*. The formulæ are based on the assumption that the extraction process consists primarily in the diffusion of the substance to be extracted through a stationary film of fluid which envelopes the separate particles of the dispersed or subdivided phase of the system. This surface film is probably nearly in equilibrium with the dispersed phase, and the rate of diffusion will be determined by the difference in concentration between the surface film and the surrounding main body of the medium. The formulæ derived are:—

For extraction of solids by liquids:

$$\log \left[1 + \frac{c_1}{x_0} (\rho - a) \right] = \frac{\delta u V}{a A^2} (\rho - a).$$

For transfer of substance from gas to liquid or *vice versa*:

$$\log \frac{x_0 - a c_0}{x} = \frac{K V}{u} (\rho - a),$$

when the velocity of the gas past the liquid is constant, as in spray washers; or

$$\log \frac{x_0 - a c_0}{x} = \frac{\delta U l}{\rho A} (\rho - a),$$

when the absorbing liquid forms a film over a stationary surface. In these formulæ c_1 or c_0 denotes the concentration of the substance to be extracted in the solution obtained, x_0 the initial and x the final concentration of the substance in the vehicle by which it is carried, a is the solubility constant of the substance, u is the velocity

of the extracting agent, U is the velocity of the vehicle carrying the substance to be extracted, V is the total volume of the extraction system, A is the cross-section of the extraction system, l is the length of the extraction system, K and δ are diffusion constants, and ρ is the weight of extracting agent per unit quantity of vehicle carrying the substance to be extracted, and is equal to u/U . In the extraction of solids by liquids perfect counter-current conditions are not realised in practice and the allowances which must be made for the introduction of a fresh tank at one end of the system and withdrawal of a tank at the other end are discussed, and auxiliary formulæ are deduced for use according to circumstances. The most striking fact brought out in the investigation is the fact that in those cases where the relation between the distribution of the substance in the original vehicle and in the extracting agent is linear, the coefficient of diffusion (K) is proportional to the square of the velocity of the gas or liquid; hence in the design of counter-current gas washers or extraction apparatus, the aim should be to obtain the maximum relative velocity of vehicle and extracting agent.—A. S.

PATENTS.

Temperatures; Means for regulating and/or indicating ——. I. Hall, Birmingham. Eng. Pat. 12,597, Sept. 2, 1915.

A MELTING pot, bath, container, or the like is provided with a pocket attached to the side either internally or externally, which communicates with the interior of the pot, and is adapted to contain a thermo-couple for measuring the temperature or controlling the heating apparatus. —W. F. F.

Desiccating and circulating air; Apparatus for ——. G. R. Grubb, Dublin, and G. S. Higginson, London. Eng. Pat. 13,567, Sept. 24, 1915.

A PORTABLE apparatus for drying and circulating air comprises a desiccating chamber, air filters,

and an air-pump driven by reducing gear from an electric motor, together with a suitable arrangement of valves.—W. H. C.

Emulsifying apparatus; Construction of ——. Maypole Margarine Works, Ltd., Southall, Middlesex. From Flakes A./S., Copenhagen. Eng. Pat. 17,306, Dec. 9, 1915.

To facilitate the opening and closing of the apparatus described in Eng. Pats. 23,653 of 1913 and 18,048 of 1914 (this J., 1914, 1167, 1218), one of the discs is supported by a hinge so that it can be swung open. When closed the discs are held together by a clamp tightened by an interrupted screw, and the joint is made by a hollow rubber ring which can be inflated with air after the discs are closed.—W. H. C.

Mixing-machines for granular or pulverulent substances. G. Porteus, Leeds. Eng. Pat. 17,600, Dec. 17, 1915.

THE ratchet-mechanism which operates the discharge worm of a mixing machine is driven by a reciprocating rod with which it is connected by a swinging bar and lever so that it can be disconnected and the discharge worm stopped without interrupting the working of the mixer.—W. H. C.

Mixing apparatus for granular, powdered, or the like material. W. S. H. Bevin and J. S. Rawsthorne, Liverpool. Eng. Pat. 101,332, July 7, 1916. (Appl. No. 9575 of 1916.)

THE material, e.g., seeds, grain or meal for cattle foods, is fed from a hopper on to a pyramidal distributor from which it falls into a receptacle divided by vertical partitions into narrow compartments. The compartments are each provided with a pivoted floor operated by hand levers through the medium of rods, chains, or wire ropes, and the material is discharged into a similar receptacle below having its vertical partitions at right angles to those above. The material is finally discharged through a hopper on to a vibrating tray and thence to a vibrating riddle and a helical conveyor.—W. F. F.

Muffle-furnace. G. W. Batchell, Cincinnati, Ohio, and J. H. Wade, Moundsville, W. Va. U.S. Pat. 1,195,641, Aug. 22, 1916. Date of appl. Mar. 18, 1916.

THE muffle chamber has a number of arched flues which extend up one side, across the top, and down the other side. A combustion flue extends longitudinally beneath the sole of the muffle, and a waste-gas flue is situated beneath the combustion flue. The arched flues communicate alternately on opposite sides with the combustion flue and on the other side with the waste gas flue.—W. H. C.

Condenser. F. F. Vega and R. Abarca, San Juan, Porto Rico. U.S. Pat. 1,195,752, Aug. 22, 1916. Date of appl., Dec. 29, 1915.

THE body of the condenser is connected on opposite sides with two vacuum pans, the vapours being prevented from passing from one pan to the other by a baffle plate. The condenser is connected with a vacuum pump, and the condensed liquid is guided to the outlet by baffles.—W. H. C.

Evaporator. F. P. Pattino and G. S. Witham, jun., Au Sabie Forks, N.Y. U.S. Pat. 1,196,020, Aug. 29, 1916. Date of appl., Nov. 29, 1915.

THE supply of liquid to an evaporator is regulated by means of a float chamber connected with both the vapour and liquid spaces of the evaporator, a mercury seal being interposed in the connection with the liquid space to prevent liquid passing from the evaporator to the float chamber.—W. H. C.

Separator; Centrifugal ——. D. B. Weston, Sharon, Mass. U.S. Pat. 1,196,056, Aug. 29, 1916. Date of appl., Dec. 1, 1911. Renewed Jan. 19, 1916.

THE material is introduced into the bottom of a drum of double conical shape which is rotated about its vertical axis. The separated solids are guided towards the top of the drum and are discharged through ports provided with valves and situated in the conical portion of the drum near the apex.—W. H. C.

Dryer. W. V. Meyer, Chicago, Ill. U.S. Pat. 1,196,376, Aug. 29, 1916. Date of appl., Jan. 3, 1914.

AN inclined rotary dryer is formed of two concentric cylinders spaced apart and having tangential shelves within each cylinder and communicating ports between the cylinders.—W. H. C.

Refrigerating apparatus. A. J. Jackson, Chicago, Ill. U.S. Pat. 1,197,636, Sept. 12, 1916. Date of appl., Jan. 2, 1915.

Cooling or heating fluids; Apparatus for ——. A. J. E. Munters, Stockholm. U.S. Pat. 1,197,944, Sept. 12, 1916. Date of appl., Sept. 17, 1914.

SEE Eng. Pat. 20,017 of 1914; this J., 1915, 1041.

Process of drying and extracting. U.S. Pat. 1,197,097. See 1X.

High-temperature centrifugal apparatus. U.S. Pat. 1,196,829. See X.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Explosive gases in coal mines; Occurrence of ——. N. H. Darton. U.S. Bureau of Mines, 1915. Bull. 72. (248 pages.)

THE following summary is based on the results of investigations made by the author in the northern anthracite basin of Pennsylvania and the southern part of the bituminous coalfield of Illinois, and on data previously obtained by other workers in Europe and America:—The gas emitted by freshly mined coal, whether *in situ* or in the laboratory, varies considerably in composition; in most cases it contains over 80% of methane, other constituents being carbon dioxide, nitrogen, and oxygen, the proportions of which are also very variable. These variations appear to be unconnected with any visible characteristics of the coal, and independent of the chemical constitution of the latter as expressed by the terms "fixed carbon," "volatile combustible matter," etc. The gas emitted at different stages of exposure, and from coal crushed to different degrees of fineness, also shows great variability in composition, for which absorption of air and subsequent combination with oxygen are doubtless largely responsible. Apparently, gas escapes from coal by percolation through the pores or interstices between the grains, and through small and large fissures, the emanation being thus dependent on the texture of the coal, the extent to which it is fissured, and the amount of pressure forcing the gas outwards. The most rapid and dangerous outbursts occur when the mining operation reaches a fissure or a body of shattered coal which constitutes a reservoir under high pressure, and when such a body of coal is thrown out in such large quantity that much of the gas is given off at once. Although occurring most often under the conditions named, or in places where the coal seam thickens and thins, such outbursts are not connected with any visible peculiarities of the coal, and no dependable means is yet available for detecting their proximity

or preventing them. The pressure of gas in the solid coal has been determined in England, France, Belgium, Austria, and Illinois with results presenting anomalous variations, the suggestion that a precise ratio exists between pressure and depth of hole being negatived by most observations. In general, high pressure, if present at all, is manifested where the coal is most compact; and owing to leakage near the face, the higher pressures are found only in the deeper test-holes, the depth necessary for a high pressure depending on the compactness of the coal. As shown by the amounts given off by mining a definite quantity of coal, and by laboratory tests on coal samples, the volume of gas in coal is as variable as the pressure. While variation in the original volume of gas is no doubt related to the organic character and history of the coal and to other factors not yet ascertained, in many cases in the mines the coal containing the most gas, or gas with the highest pressure, does not have the most gaseous workings, the gas being emitted gradually over a long period and thus easily disposed of by adequate ventilation. Tests made to determine the amounts of gas given off by coals at ordinary temperature and at 212° F. (100° C.), in a vacuum, in the presence of various other gases, and in different periods of time, yielded a wide range of results without revealing any special relations. The volume of gas emitted generally increased with the time of exposure; and the rate of emission with the degree of fineness of the sample. At ordinary temperature coal yielded up to 5.5 times, and at 212° F. up to 8 times its own volume of gas; but the average yield at ordinary temperature was probably less than the volume of the coal employed, and however great the quantity liberated at first exposure, a long time always elapsed before the emission was complete. As regards the relation of methane accumulations to explosions in mines, deductions based on statistics are considered misleading, since most of the explosions on record are known to have been started by accidental ignition and many of the larger ones propagated mainly by coal dust, the controlling cause of most of the accidents being the human factor and not increased methane emanation due to atmospheric or other influences. Generally, fewer accidents occur during times of evident danger than when the need for precaution is less apparent.—W. E. F. P.

Coal: Spontaneous combustion and oxygen absorption by—J. I. Graham. Inst. of Min. Eng. J. Gas Lighting, 1916, 136, 20.

EXPERIMENTS on the formation of water in the oxidation of coal show that a very considerable proportion of water is produced relative to the quantity of oxygen absorbed, the proportion increasing slightly with the time of oxidation. The amount of water produced in the initial stages of an underground heating is small compared with the amount of water already in the coal. Experiments dealing with the permeability of coal to air and gas show that solid coal is extremely airtight, and that the amount of oxygen which can permeate any distance into a solid pillar of coal is quite negligible, but "breaks" in coal, letting in oxygen, may cause heatings and fires in the walls of main roads many years after the roads have been cut.—J. E. C.

Coal economy in London. [Utilisation of coke in boiler-furnaces.] E. W. Nicol. J. Gas Lighting, 1916, 136, 17. (See also this J., 1916, 460.)

THE author gives further data relating to the use of gas coke for steam-raising. Tests carried out at one of the stations of the Metropolitan Asylums Board show an overall efficiency of 78%, well above the average realised with coal-fired boilers. The consumption of fuel has been reduced by

10%, and the average evaporation (from and at 212° F.) of 9.94 lb. of water per lb. of coke has been attained.—J. E. C.

Briquetting and tar distilling plant at Nuremberg gasworks. R. Terhaest. J. Gasbeleucht., 1915, 58, 300—301. J. Gas Lighting, 1915, 130, 755.

COKE breeze and pitch dust are incorporated in a mixer heated by superheated steam at 200° C. and the mixture treated in a rotary press; 8% of hard pitch is used and the crushing strength of the oval briquettes averages 80 kilos. (1137 lb. per sq. in.). The strength of the briquettes depends chiefly on three factors—viz.: the proportion of binding material; the description or softness of the pitch used; and the pressure (15 tons) which the outer edges of the two rollers exert on one another. The proportion of pitch added cannot be varied much, because if it is too low the briquettes lack solidity or strength, and if it is too high they stick in the mould. The resistance of the briquettes to pressure in the direction of the small axis of the oval is tested by a very simple apparatus. A piston working in a short cylinder is of such a size that, at 9 atmospheres, it exerts a pressure of 120 kilos. The briquette resting on a plate is compressed by the piston. The cylinder is connected with the steam-pipe, so that only condensed water passes under the piston. When the steam valve is slowly opened, the pressure, read on a gauge, gradually rises until a small jerk shows that the briquette has been crushed. The briquettes are suitable for steam boilers or household purposes. They now serve as fuel for the whole of the boilers on the works, and a considerable quantity remains over for sale. The boilers produce more steam in a given time, and require less attendance and cleaning, and less dust is produced. Excluding cost of material, the cost of manufacturing is only 30 Pf. per 100 kilos. briquettes (3s. per ton). In the Nuremberg gasworks the pitch required for making the briquettes is about double the quantity of retort pitch produced; the balance is obtained from the tar plant which splits up the tar into hard pitch, light oil (up to 170° C.), and heavy oil (up to 360° C.). Naphthalene wash oil is regenerated in this plant.—J. E. C.

Lignites: Economic methods of utilising Western (U.S.A.)—E. J. Babcock. Bull. 89, U.S. Bureau of Mines. 73 pages.

THE bulletin deals with the economical use of lignites, with special reference to schemes comprising the distillation of the lignites, collection of by-products (sulphate of ammonia and tar), utilization of the gas evolved, and conversion of the solid residue into briquettes. The bulletin quotes average yields of 11,038 cub.ft. of gas per ton (396 B.Th.U. per cub.ft.), 54.0% of residue, 17.4 lb. of sulphate of ammonia per ton, and 50.7 lb. of tar per ton. A good working temperature is given as 1200°—1400° F. (650°—760° C.). In abrasion and compression tests, lignite briquettes compared favourably with anthracite and bituminous coals. Briquettes made from the coked residue were found superior to briquettes made from the raw lignite.—J. E. C.

Calorific power of lignites; Use of ammonium nitrate in determining the—R. Salvadori. Annali Chim. Appl., 1916, 6, 113—114.

SATISFACTORY combustion of lignites, even of samples containing 50% of water, in a Thomson calorimeter can be obtained by adding ammonium nitrate to the usual mixture of potassium chlorate and nitrate. Using 2 grms. of the sample a mixture of 20 grms. of the chlorate-nitrate mixture (3:1) and 1 gm. of ammonium nitrate is recommended. With these quantities and using

2 kilos. of water in the glass cylinder of the calorimeter, a correction of 0.54° C. should be deducted from the observed temperature. If necessary 18 grms. of the chlorate-nitrate mixture and 3 grms. of ammonium nitrate may be used, in which case the correction is 1.62° C.—A. S.

Acetylene; Colorimetric determination of—A. Schulze. *Z. angew. Chem.*, 1916, 29, 341—342.

ILOSVAY'S reagent (solution of a copper salt decolorised with hydroxylamine hydrochloride; this J., 1899, 1158) is used for the colorimetric determination of acetylene. The solution is prepared from copper chloride, as described, but an addition of 6 c.c. of 2 to 3% gelatin solution is made to prevent the precipitation of colloidal copper acetylides. A measured quantity (50 c.c.) of the mixture of air and gas is aspirated by means of a capillary tube through 5 c.c. of the reagent, and the coloration is matched with that produced by a given quantity of air containing 1% of acetylene. The test is capable of detecting 0.001 c.c. of acetylene.—C. A. M.

Platinum and illuminating gas. Mylius and Hüttner. *See X.*

Use of powdered coal in metallurgical furnaces: a discussion of the engineering problems involved. Gadd. *See X.*

PATENTS.

Mond gas; Utilisation of—and the recovery of by-products [ammonium nitrate] therefrom. T. Twynam, Redcar, Yorks. Eng. Pat. 14,391, Oct. 12, 1915.

MOND gas is utilised to produce electrical energy which is used in electric furnaces for the combination of atmospheric oxygen and nitrogen, from which nitric acid is manufactured. The ammonia from the Mond gas is absorbed in the nitric acid, forming ammonium nitrate.—W. F. F.

Peat or other carbonaceous matter; Process of producing power [gas] from—G. F. Dinsmore, Boston, Mass., Assignor to Dinsmore Power Process Co. U.S. Pat. 1,197,456, Sept. 5, 1916. Date of appl., May 24, 1909. Renewed Nov. 5, 1914.

A MASS of fuel is maintained incandescent in a pressure-tight vessel by forcing in compressed air, and regulated supplies of wet peat are added. The peat is converted into fixed combustible gas and steam, which is used in a pressure engine. The steam in the exhaust is condensed, and the gas is burnt for power purposes.—W. F. F.

Vertical retorts; Apparatus for charging and discharging—S. N. Wellington, London Eng. Pat. 13,254, Sept. 16, 1915.

II.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Electrodes; Arc-light—C. R. Böhm. *Chem.-Zeit.*, 1916, 40, 637—639, 655—657, 667—669, and 680—683.

THE development of the arc-light carbon industry is traced and the patent literature dealing with the manufacture of simple, cored, impregnated, and other types of electrode critically reviewed, whilst the behaviour of the various types of electrode under burning conditions in the lamp is discussed. Pure carbons are shown to be steadily giving place to treated carbons for the production of so-called flaming arcs, especially in Germany where, in 1913, only 61.5% of those sold were of

the former type. There is a heavier import duty on German carbons entering the United States and Canada than on carbons imported from other countries, the difference amounting to 13—14% and 37—87% *ad val.* respectively. A bibliography is appended to the paper.—F. SODN.

PATENTS.

Bituminous substances; Process for distilling—J. G. Aarts, Dongen, Holland. Eng. Pat. 100,952, July 17, 1916. Under Int. Conv., July 17, 1915. (Appl. No. 10,024 of 1916.)

BITUMINOUS substances, e.g. coal, peat, wood, are distilled in vertical retorts of substantially constant cross-section. The charge moves downwards and the retort is heated externally by gas in zones varying from over 1500° C. at the bottom to below 500° C. at the top. The resulting gas is free from naphthalene and heavy tar, and rich in ammonia and benzene.—W. F. F.

Incandescent electric lamp. R. Winne, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,197,705, Sept. 12, 1916. Date of appl., Apr. 24, 1913.

SEE Eng. Pat. 18,447 of 1913; this J., 1914, 913.

III.—TAR AND TAR PRODUCTS.

Phenols; Identification of—by the spectroscope. H. Gsell. *Z. anal. Chem.*, 1916, 55, 417—426.

INDIVIDUAL phenols can be readily identified by the measurement of the darkest bands in the absorption spectra of alkaline solutions of their corresponding phthaleins. 0.1—0.2 gm. of the phenol, 0.03—0.1 gm. of phthalic anhydride, and 1—2 drops of concentrated sulphuric acid or stannic chloride solution, are heated together for 10—15 minutes in a paraffin bath at 140°—180° C., and after the addition of a few c.c. of alcohol and 10—12 c.c. of N/20—N/50 sodium hydroxide, the liquid is filtered and examined spectroscopically. The method is simple, reliable, and exact, though obviously not applicable to phenols which do not yield coloured phthaleins. Measurements were made on 20 phthaleins derived from monohydric phenols, and also on the corresponding derivatives of resorcinol, naphthoresorcinol, quinol, and thymol.—E. H. T.

2.7-Dimethoxynaphthalene. O. Fischer and W. Kern. *J. prakt. Chem.*, 1916, 94, 34—48.

THE main products of the nitration of 2.7-dimethoxynaphthalene are the 1-nitro- and the 1.8-dinitro-derivatives. The former forms yellow prisms or plates, m.pt. 141° C., and is reduced by stannous chloride to the corresponding amine, white silky needles, m.pt. 82°—83° C., which become violet on exposure to light. Alcoholic ammonia at 190°—200° C. replaces a methoxyl group of the nitro-compound by the amino-group, the resulting 1-nitro-2-amino-7-methoxynaphthalene forming reddish-yellow needles, m.pt. 115°—116° C. On reduction it is converted into 1.2-diamino-7-methoxynaphthalene, the constitution of which follows from its condensation with benzil to 7-methoxy-1.2-diphenyl-naphthoquinoline, m.pt. 168° C. The 1.8-dinitro-derivative of dimethoxynaphthalene yields a similar series of derivatives to the above, but it is noteworthy that by the action of alcoholic ammonia or methylamine both methoxy-groups are replaced by amino-groups.—G. F. M.

Briquetting and tar distilling plant at Nuremberg gas works. Terhaest. *See IIA.*

Changes in the import duties on dyestuffs, etc., in the United States. See IV.

PATENTS.

Nitriles; Preparation of—. Act.-Ges. f. Anilinfabr. Ger. Pat. 293,094, Jan. 24, 1914.

AROMATIC compounds containing halogen combined directly with the nucleus are mixed with finely divided or dissolved, simple or complex metallic cyanogen compounds, with addition of a substance which promotes the reaction, and heated to temperatures up to 350° C. Halogen compounds in which the halogen atom is "mobile" owing to the presence of an *ortho* or *para* nitro group are not suitable, and the action of cuprous cyanide on halogenanthraquinones is disclaimed. Examples given are:—(1) 14 parts of finely ground anhydrous calcium ferrocyanide, 6 of fullers' earth, 1 of copper ("Naturkupper C"), and 44 of chlorobenzene, heated for 20 hours at 300°–320° C.; (2) 18 parts of *a*-chloronaphthalene, 60 of pyridine, and 8 of copper ferrocyanide heated for 18 hours at 270° C.—A. S.

5,8-Dichloro-1-nitronaphthalene; Preparation of—. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 293,318, Dec. 24, 1914.

5,8-DICHLORO-1-NITRONAPHTHALENE is obtained by chlorination of *a*-nitronaphthalene in presence of a chlorine-carrier.—A. S.

Benzyl chloride sulphonic acids and their homologues; Preparation of salts of—. Rohner und Co., Pratteln, Switzerland. Ger. Pat. 293,319, Aug. 29, 1914.

DAX salts of toluenesulphonic acids or their homologues, suspended in an inert medium, such as carbon tetrachloride, tetrachloroethane, etc., are treated with chlorine, the reaction mixture being boiled under a reflux condenser during the operation.—A. S.

IV.—COLOURING MATTERS AND DYES.

1,6-Dihydroxynaphthalene. O. Fischer and C. Bauer. J. prakt. Chem., 1916, 94, 1–12.

A NUMBER of derivatives of 1,6-dihydroxynaphthalene, m.pt. 137°–138° C., are described, of which the following are the most important:—The dibenzoyl-derivative, m.pt. 103°–104° C.; 1,6-dimethoxynaphthalene, obtained in colourless needles, m.pt. 60°–61° C., by the action of methyl sulphate; 2-nitroso-1,6-dihydroxynaphthalene, as red glittering leaflets, and 4-nitroso-1,6-dihydroxynaphthalene as bright yellow needles by the action of nitrous acid on dihydroxynaphthalene. On reduction with stannous chloride and hydrochloric acid these nitroso-compounds are converted into the corresponding amino-derivatives. The tin double salt of 4-amino-1,6-dihydroxynaphthalene is readily oxidised by ferric chloride to 6-hydroxy-1,4-naphthoquinone, a reddish-yellow substance melting at 170° C. (with decomp.), and yielding on gentle reduction with stannous chloride 1,4,6-trihydroxynaphthalene, a somewhat unstable substance melting at 138°–140° C. By the action of phenyldiazonium chloride on 1,6-dihydroxynaphthalene, mono-, bis-, and tris-azo-compounds were produced according to conditions. 4-Benzene-azo-1,6-dihydroxynaphthalene forms red needles, m.pt. 230° C., and dyes orange-red shades. Bis-azobenzene-1,6-dihydroxynaphthalene forms dark red flakes and is more sparingly soluble than the mono-azo compound. The trisazo-compound forms dark metallic-looking needles.—G. F. M.

1,5-Dihydroxynaphthalene. O. Fischer and C. Bauer. J. prakt. Chem., 1916, 94, 13–23.

COMMERCIAL 1,5-dihydroxynaphthalene can be purified by treatment in suspension in dilute alcohol, with steam, followed by sulphur dioxide. On filtering and cooling the liquor, it separates in colourless needles, m.pt. 258° C. Its dibenzoyl- and diethyl-derivatives melt at 235° C. and 130° C. respectively. The monomethyl ether is formed as the principal product when methyl sulphate acts on 1,5-dihydroxynaphthalene in presence of 1½ mols. of potassium hydroxide. It melts at 68° C., and is converted by nitrous acid into 5-methoxy-2-nitroso-1-naphthol, m.pt. 165° C. (with decomp.), and this on reduction with phenylhydrazine gives the corresponding aminonaphthol as glistening leaflets, which rapidly colour when not perfectly dry. By the action of nitrous acid on 1,5-dihydroxynaphthalene only a mononitroso-derivative is formed, viz., 2-nitroso-1,5-dihydroxynaphthalene, reddish-brown needles, decomposing at 190° C. The dihydroxynaphthalene and its monomethyl ether yield yellow to red mono-azo-compounds on coupling with phenyldiazonium chloride or its substitution products. Bisazo-derivatives can also be obtained.—G. F. M.

2-Hydroxy-7-methoxynaphthalene. O. Fischer and F. Hammerschmidt. J. prakt. Chem., 1916, 94, 24–34.

2-HYDROXY-7-METHOXYNAPHTHALENE was obtained in flat plates of m.pt. 117° C. by methylation of the dihydroxy compound with methyl sulphate and potassium hydroxide (1 mol.). A number of derivatives were prepared by the usual methods (see preceding abstract), e.g., the 1-nitroso-derivative forming bronze-coloured needles, m.pt. 129° C., and the 1-amino-derivative, white leaflets, m.pt. 170° C. By the action of ammonia, methylamine, and ethylamine on the nitroso-compound the hydroxyl group was replaced by an amino group, with formation of 1-nitroso-2-amino-7-methoxynaphthalene, yellowish-brown needles, m.pt. 191° C., and its *N*-methyl- and *N*-ethyl derivatives. These bases are re-converted into the hydroxynaphthalene by warming with dilute sodium hydroxide. Yellow and red azo-dyestuffs were obtained by coupling 2-hydroxy-7-methoxynaphthalene with phenyldiazonium chloride and *p*-nitrophenyldiazonium chloride respectively. The azo-complex enters the 1-position.—G. F. M.

Dyestuffs, etc.; Changes in the import duties on— in the United States. Board of Trade J., Oct. 12, 1916.

THE Bill passed by the House of Representatives on July 10th, dealing with the duties to be levied on dyestuffs and intermediate products imported into the United States, has been passed by Congress and was approved on Sept. 8th subject to the following modifications in the original (this J., 1916, 885):—

Group I. (Free list). In place of "anthracene," "carbazol," and "naphthalene," there are now inserted "anthracene having a purity of less than 25%," "carbazole having a purity of less than 25%," and "naphthalene having a solidifying point less than 79° C."; *o*-, *m*-, and *p*-cresols having a purity of less than 90% are added.

Group II. The following additions have been made:—Anthracene having a purity of more than 25%, benzoic acid, carbazol having a purity of more than 25%, naphthalene having a solidifying point of 79° C. or above, *o*-, *m*-, and *p*-cresols having a purity of 90% or more. The last sentence of the paragraph now reads "all the foregoing not colours, dyes, or stains, photographic chemicals, medicinals, flavours," etc.

Group III. Medicinals, flavours, and synthetic phenolic resin are added. The special duty of 5c. per lb. does not apply to medicinals and flavours.

Influence of catalysts (alkaloids, dyes, etc.) on yeast fermentation. Somogyi. See XVIII.

Soap as indicator in volumetric analysis. [Titration of solutions of colouring matters.] Sacher. See XXIII.

PATENTS.

Gallocyanine series; Manufacture of blue to greenish-blue colouring matters of the —. G. B. Ellis, London. From Chemical Works, formerly Sandoz, Bâle, Switzerland. Eng. Pat. 101,301, Jan. 4, 1916. (Appl. No. 145 of 1916.)

New condensation products are obtained by condensing gallocyanine dyestuffs with *m*- and *p*-aminobenzamide in presence or absence of oxidising agents. *Example:* 180 kilos. of *m*-aminobenzamide and 60 kilos. of Coelestine Blue are heated for 4–5 hrs. at 110° C., with or without an oxidising agent, e.g., air or aromatic nitro-compounds, the melt is extracted with hot water, and the condensation product is filtered off. The condensation may be carried out in alcoholic solution. The leuco-compound is readily soluble in water, and when printed with chromium acetate or formate mordant gives, after steaming for a short time, greenish-blue shades of remarkable purity and of excellent fastness to light, soap, and chlorine.

—F. W. A.

Indoxyl, its homologues, and their derivatives; Manufacture of —. E. A. Bourcart, Paris. Eng. Pat. 101,316, Apr. 1, 1916. (Appl. No. 4832 of 1916.)

In the manufacture of indoxyl, its homologues, or their derivatives, an arylglycinate, or a homologue or derivative, is fused with a dehydrated mixture of caustic soda and caustic potash, in the presence of an inorganic substance capable of decomposing water, in an autoclave under a pressure of 6 to 10 atm. *Example:* Into an autoclave fitted with a stirrer is introduced a dehydrated and heated mixture of 70 parts of caustic potash and 30 parts of caustic soda to which is added 30 parts of sodamide, and the pressure is raised to 6 to 10 kilos. by means of ammonia or aniline vapours. When the temperature has fallen to 180° C., 50 parts of potassium phenylglycinate is introduced as quickly as possible while the temperature is prevented from rising substantially above 190° C. As soon as the evolution of ammonia has ceased, the melt is dissolved in iced water, and indigo precipitated by the usual methods.—F. W. A.

Dyestuffs of the acridine series; Preparation of —. Act.-Ges. f. Anilinfabr. Ger. Pat. 292,848, Apr. 23, 1915.

YELLOW to orange-red dyestuffs giving level shades, fast to lime, and hence of special value for dyeing leather, are obtained by fusing together formyl derivatives of *m*-diamines of the benzene series and salts of *N*-monoalkyl or unsymmetrical *N*-dialkyl derivatives of such *m*-diamines.—A. S.

Sulphur dyestuffs; Preparation of —. Act.-Ges. f. Anilinfabr. Ger. Pat. 293,186, Jan. 22, 1914.

DYESTUFFS giving fast shades are obtained by heating azo compounds of *N*-ethyl-arylamines with sulphur to a high temperature, with or without addition of aromatic amines or compounds especially nitroamines, capable of yielding amines.—A. S.

Sulphur dyestuffs; Preparation of —. Act.-Ges. f. Anilinfabr. Ger. Pat. 293,557, Jan. 29, 1914.

Fast yellow dyestuffs, which, unlike those described in Fr. Pat. 394,832 of 1908 (this J., 1909, 305), are resistant to chlorine, are obtained by the action of sulphur on a mixture of *m*- or *o*-phenylenediamine or nitroaniline with toluidines or xylydines.—A. S.

[Azo] dyestuffs; Preparation of diazotisable —. Act.-Ges. f. Anilinfabr. Ger. Pat. 293,334, Sept. 11, 1915.

A 1-AMINO-8-NAPHTHOLSULPHONIC acid or an *o*-acydyl derivative is diazotised and coupled with a suitable amino compound of the benzene or naphthalene series, with the exception of 1-amino-5-naphthol and its 6- or 7-sulphonic acids, and ethers of 1-amino-2-naphthol and their derivatives, and the aminoazo compound is diazotised and coupled with a derivative of 2-amino-5-naphthol-7-sulphonic acid containing a diazotisable amino group. When an acydl derivative is used, the acydl group is removed after the first or second coupling. The products dye cotton blue shades which are converted into clear green tints, fast to washing and to light, by diazotising, and developing with pyrazolone derivatives or compounds containing a CO.CH₂CO group, e.g., acetoacetanilide.—A. S.

Triarylmethane dyestuffs; Preparation of —. Farb. vorm. Meister, Lucius, u. Brünig. Ger. Pats. (A) 292,998, Nov. 10, 1914, and (B) 293,322, Dec. 25, 1914.

DYESTUFFS giving fast shades are obtained by heating triarylmethane dyestuffs containing (A) a nitro group or (B) an esterified hydroxyl group in the para position to the methane carbon atom, with unsubstituted or substituted primary aromatic amines, with or without addition of salts of the amines.—A. S.

Monouzo dyestuffs for wool; Preparation of —. Farb. vorm. Meister, Lucius, u. Brünig. Ger. Pat. 293,473, July 1, 1914.

DYESTUFFS giving level shades fast to washing and to alkalis are obtained by coupling diazotised amino-sulphonic or amino-carboxylic acids of the benzene or naphthalene series, with the exception of *o*-aminophenol derivatives, with 2-amino-7-naphthol in alkaline solution. The fastness of the dyed shades is improved by treatment with formaldehyde.—A. S.

Anthraquinone series; Preparation of a nitrogenous condensation product of the —. Farb. vorm. Meister, Lucius, u. Brünig. Ger. Pat. 293,576, July 23, 1913.

A PRODUCT of value for the manufacture of dyestuffs is obtained by heating 1-amino-5-methylanthraquinone with an alkali alkyl oxide.—A. S.

Sulphur dyestuffs; Preparation of yellow —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 293,558, Mar. 26, 1915. Addition to Ger. Pat. 292,148 (this J., 1916, 832).

OTHER *N*-diacydl derivatives are used in place of the *N*-diacydl derivatives specified in Ger. Pat. 293,187 (this J., 1910, 922). The products give pure yellow shades, clearer than those given by the dyestuffs described in the chief patent. Except in the case of the benzoyl derivatives, "souring" of the dyed material is not necessary.—A. S.

Dyestuffs of the pyrone series; Preparation of chrome —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 293,185, Dec. 10, 1914.

CHROME dyestuffs giving red shades are obtained by condensing 2,4-dihydroxybenzene-1-carboxylic

acid esters or their homologues with benzo-tri-halides or their nucleus substitution derivatives, and saponifying the products.—A. S.

Quinophthaloneulphonic acids containing halogen (halogenated Quinoline Yellow dyestuffs), and process of making same. E. Hoffa, Assignor to Farbwerke vorm. Meister, Lucius, u. Brüning, Höchst, Germany. U.S. Pat. 1,197,632, Sept. 12, 1916. Date of appl., Apr. 6, 1914.

SEE Eng. Pat. 8577 of 1914; this J., 1914, 713.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

PATENTS.

Cotton: Treatment of raw—O. Röhm, Darmstadt, Germany. Eng. Pat. 100,224, Mar. 7, 1916. (Appl. No. 3383 of 1916.) Under Int. Conv., Mar. 29, 1915.

THE treatment of raw cotton with boiling alkalis, preparatory to bleaching, is omitted, and the material is softened by steeping in a 0.1% aqueous solution of pancreatin at 20°–40° C. for some hours and then bleached with the usual agents. Other enzymes, such as papayotin, ricinus enzymes, etc., may be used, or fresh organs or preparations, instead of the commercial enzyme.—J. F. B.

Wool, hirsute and other animal fibres, fabrics or textiles: Process for treating—, and the products. H. P. Jefferson, Boston, Mass. U.S. Pat. 1,197,495, Sept. 5, 1916. Date of appl., Sept. 18, 1914.

RAW wool is treated in a continuous process under diminished pressure, first with an acid gas, such as carbon dioxide, to render soluble the substances which otherwise would form an emulsion, then with cold distilled water to remove the soluble substances, and next with a preheated weak alkaline solution containing suint ingredients. The solution is drained off and the moisture removed by centrifuging the goods and treating with preheated compressed air. The material is extracted with a preheated volatile fat-solvent, e.g., trichloroethylene, and subjected under diminished pressure to heated carbon dioxide, hot water, and cold water successively. The mass is finally dried by centrifuging and treatment with hot compressed air.—J. F. B.

Textile materials: Process of treating (with rubber)—and the article produced thereby. W. J. Mellersh-Jackson, London. From Rubber Regenerating Co., New York. Eng. Pat. 101,318, Apr. 13, 1916. (Appl. No. 5403 of 1916.)

FIBROUS material, animal or vegetable, combed or carded so that the fibres are disposed substantially parallel to one another, is subjected to a vacuum to displace the air, etc., from the interior of the fibres and the interstices, and impregnated in this condition with a binding medium, e.g., rubber, with or without heat, so that there is intimate and direct contact with the binding medium both in the interior ducts and around the fibres.—J. F. B.

Pyroxylin compositions: Method of producing—C. E. Arnold, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,195,431, Aug. 22, 1916. Date of appl., Feb. 3, 1915.

ABOUT 150 parts of celluloid scrap and 200 parts of a volatile solvent are mixed in a tumbling drum which is rotated at approximately the minimum rate necessary to impart a constant flow to the jelly produced, i.e., about two revolutions per minute.—F. Sp.

Waterproofing the soles of footwear (with cellulose acetate). A. V. St. Armande, Nitschill, Renfrew. Eng. Pat. 12,839, Sept. 8, 1915.

A LAYER of cellulose acetate, to which may be added a little β -naphthol as a germicide, is inserted between the inner and the outer sole of a boot or shoe.—J. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

PATENTS.

Cotton fabrics: Process for imparting novel effects to—Heberlein & Co., Wattwil, Switzerland. Eng. Pat. 100,483, May 1, 1916. (Appl. No. 6218 of 1916.) Under Int. Conv., May 19, 1915.

TRANSPARENT and wool-like effects on cotton fabrics are obtained by alternate and repeated treatment with alkali-lye of over 15° B. (sp.gr. 1.116) and sulphuric acid of over 48° B. (sp.gr. 1.498). The sulphuric acid may be replaced by phosphoric acid of 55° to 57° B. (sp.gr. 1.610–1.652), hydrochloric acid (sp.gr. 1.19) below 0° C., nitric acid of 43° to 46° B. (sp.gr. 1.424–1.468), or zinc chloride solution of 66° B. (sp.gr. 1.843) at 60°–70° C. The fabric may be subjected to longitudinal or transverse tension during treatment, and pattern effects may be produced by printing with the acid or alkali or with a resist.—F. W. A.

Patterns and woolly effects on fabrics: Production of—E. Zeidler, Guntramsdorf, Austria. Ger. Pat. 293,400, Apr. 21, 1914. Under Int. Conv., Mar. 30, 1914.

UNION fabrics are printed with reserves which are capable of destroying one of the two kinds of fibres present, and woolly effects are produced on the unreserved parts of the fabric by raising the nap in the usual manner. The material is then subjected to a high temperature to cause the reserve to exert its destructive action, and thoroughly washed. For destroying the vegetable fibre a suitable reserve consists of a mixture of 200 parts of sulphuric acid of 86° B. (sp.gr. 1.84) and 800 parts of dextrin thickening (2 of dextrin to 1 of water); and for destroying the animal fibre, a mixture of 600 parts of caustic soda of 40° B. (sp.gr. 1.35) and 600 parts of dextrin thickening (2:1). When the latter is used, dextrin, glucose, glycerin, or gelatin should be added to the wash water to prevent damage of the animal fibre in the unreserved parts. Dyestuffs, etc., may be added to the reserve to colour the fibres which are not destroyed.—A. S.

Hairs, furs, skins, or the like: Process of dyeing dead or living—F. Fresenius and A. Zimmer, Frankfurt. Ger. Pat. 293,232, Dec. 23, 1914. Addition to Ger. Pat. 291,138.

IN the process described in the chief patent (this J., 1916, 834), ammonium molybdate solution was used in conjunction with aromatic hydroxy or amino compounds and metallic salts. It has since been found that other compounds of molybdic acid, e.g., potassium or sodium molybdate, may be used in place of the ammonium salt.—A. S.

Trisazo dyestuffs: Preparation of green substantive—[on the fibre]. Art.-Ges. f. Anilinfabr. Ger. Pat. 293,358, July 14, 1915. Addition to Ger. Pat. 288,278 (see Eng. Pat. 8996 of 1915; this J., 1915, 1136).

SECONDARY disazo dyestuffs formed with a 1-aminobenzoilamino-8-naphtholsulphonic acid as an end component, are converted on the fibre into fast green trisazo dyes either by diazotising and

coupling with a pyrazolone derivative, α -methyl-indole, or a compound containing a $\text{CO}, \text{CH}_2, \text{CO}$ group, or by treatment with a suitable diazo compound.—A. S.

White or coloured reserves in printing with chrome colours. Durand, Huguenin et Cie. Ger. Pat. 293,359, July 13, 1915.

THE material is printed first with a reserve containing a reducing agent and citrate, and also some "Blandola" (pure vegetable gelatin) and then with a paste containing the colour and mordant, and is afterwards steamed for a short time and thoroughly washed. The process is applicable with gallocyanines and their leuco-derivatives and bisulphite compounds, and the bisulphite compounds of Alizarin Blue and Coerulein.—A. S.

Azo dyes on the fibre; Process of producing yellow insoluble—. E. Hoffa, Assignor to Farb. vorm. Meister, Lucius, u. Brünig, Höchst, Germany. U.S. Pat. 1,197,633, Sept. 12, 1916. Date of appl. June 15, 1915.

SEE Eng. Pat. 8489 of 1915; this J., 1916, 466.

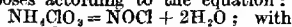
VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Salt-petre; The reciprocal salt-pairs $\text{KCl} + \text{NaNO}_3 \rightleftharpoons \text{KNO}_3 + \text{NaCl}$, and the preparation of "conversion"—. W. Reinders. Z. anorg. Chem., 1915, 93, 202–212. Chem.-Zeit., 1916, 40, Rep., 305.

CONDITIONS for the separation of the single salts in the equilibrium $\text{KCl} + \text{NaNO}_3 \rightleftharpoons \text{KNO}_3 + \text{NaCl}$ were obtained by a graphical method. At 5°, 50°, and 100° C., the solubility of sodium nitrate rises with an increase of potassium nitrate. In practice, for the preparation of potassium nitrate, a slight excess of sodium nitrate is desirable; and, after heating at 100° C. and removing the sodium chloride, the addition of water prevents the separation of sodium chloride with the potassium nitrate and saves subsequent washing.—F. SODN.

Ammonium nitrate; Action of — on potassium chlorate. R. Salvadori. Annali Chim. Appl., 1916, 6, 115–118.

WHEN a mixture of potassium chlorate and ammonium nitrate is heated at atmospheric pressure, reaction begins at about 120° C. and proceeds uniformly throughout the mass, a residue of potassium nitrate being left; during the decomposition a yellow liquid distils over, probably nitrosyl chloride. Calorimetric investigation of the reaction showed that the thermal effect per 1 gm. of ammonium nitrate is 1080 calories in the Thomson calorimeter and 1550 calories in the Mahler bomb. The solid residue in both cases is potassium nitrate, and the difference is due to differences in the mode of decomposition of ammonium chlorate in the two cases. The thermal effect due to the decomposition of 1 gm. of ammonium chlorate in the Mahler bomb is 698.5 calories. At 90° C. ammonium chlorate decomposes according to the equation:



as a secondary reaction. At high temperatures the reaction: $2\text{NOCl} + \text{H}_2\text{O} = 2\text{HCl} + \text{NO} + \text{NO}_2$, takes place.—A. S.

Sodium nitrate industry in Chile. Oil, Paint, and Drug. Rep., Sept. 25, 1916.

THE production and exportation of sodium nitrate from Chile continues to increase, the figures for

the year ended June 30, 1916, being 70% in excess of those for the preceding year, though still somewhat lower than before the war. Production in 1915–1916 amounted to 57,715,614 Spanish quintals and exports to 55,285,814 quintals, compared with 62,322,617 and 58,751,291 quintals respectively in 1913–1914. Production in June, 1916, amounted to 5,153,701 quintals. Prices have not varied much recently, having been about 7s. 6d. per quintal for the 95% product, immediate delivery.

Iodine in Slassfurt sylvine and carnallite. L. W. Winkler. Z. angew. Chem., 1916, 29, 342–343.

MANY samples of Slassfurt sylvine and carnallite contained no iodine, whilst others contained small amounts ranging from 1.5 to 73.1 mgrms. per kilo. —C. A. M.

Iodine and starch iodide in aqueous media; Action of X-rays on —. H. Bordier. Comptes rend., 1916, 163, 291–293.

THE action of X-rays on aqueous solutions of iodine and iodide of starch is analogous to that of light previously studied (this J., 1916, 962). The phenomena of decolorisation observed after some hours' exposure to light rays have been explained as the result of the ionising action of the violet and ultraviolet rays on the colloidal pseudo-solutions, and it is noted that the far more powerful ionising action of X-rays produces the same effect in a few minutes.—J. F. B.

Use of solutions of ammonium salts for the treatment of wood. Moll. See IX.

Quantitative analysis of antimony trisulphide and the products obtained from it by roasting. Von Bacho. See X.

"Marine kainit." See XVI.

Investigation of the chief methods of detecting hydrocyanic acid. Anderson. See XXIII.

Recovery of molybdic acid and ammonium nitrate from the residues from phosphoric acid determinations. Grete. See XXIII.

Titrimetric studies. [Titration of hydrogen peroxide and hydrogen sulphide.] Enell. See XXIII.

PATENTS.

Nitric acid; Process of concentrating—. F. C. Zeisberg, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,197,167, Sept. 5, 1916. Date of appl. Oct. 15, 1914.

NITRIC acid and a dehydrating agent, such as sulphuric acid, are continuously passed into a chamber, from which the nitric acid is driven off by contact with steam from a boiling solution of the dehydrating agent or from weak nitric acid previously concentrated by the process. The diluted sulphuric acid is continuously removed, the nitric acid vapour condensed, and the residual oxides of nitrogen recovered by absorption in water.—F. SODN.

Sulphuric acid [and cement]; Manufacture of—. L. P. Basset, Paris. U.S. Pat. 1,197,331, Sept. 5, 1916. Date of appl. July 5, 1916.

A MIXTURE, comprising clay and a material containing calcium sulphate, is heated sufficiently to produce cement and gases containing sulphur dioxide. The latter, mixed with air, are passed into contact with a catalytic substance, comprising natural hydrated iron oxide mixed with gypsum. The sulphur trioxide is removed, and the unconverted sulphur dioxide is absorbed in a calcareous material suitable for use in the production of cement.—B. N.

Hypochlorous acid; Manufacture of—W. N. Haworth and J. C. Irvine, St. Andrews, Fife. Eng. Pat. 12,912, Sept. 9, 1915.

CHLORINE is passed into water containing a catalyst, which is preferably a salt or oxide of copper, but may also be a nickel or cobalt salt. The mixture is placed in a series of bottles which are agitated on a shaking machine, and the chlorine, derived from the liquid element, is passed through the inlet tube of each series. The resulting liquid, which contains about 2% of hypochlorous acid, may be freed from dissolved copper by precipitation, or by distilling off the acid. For each bottle of 1½ litres capacity, from 80–100 grms. of catalyst is used, but in the case of copper oxychloride only 10 grms. is necessary.—E. H. T.

Acetic acid and the like; Process for distilling—A. Bräuer, Assignor to Chem. Fabr. Grünau, Landshoff u. Meyer A.-G., Grünau, Germany. U.S. Pat. 1,196,329, Aug. 29, 1916. Date of appl., Mar. 28, 1916.

ACETIC acid is prepared by covering the surface of a heated rotating surface evaporator with a mixture of an acetate and sulphuric acid, and scraping off the solid residue which remains after the acetic acid has evaporated, before a fresh supply of the mixture is taken up.—F. Sp.

Sodium thiosulphate; Manufacture of—W. S. Hutchins, L. Hargreaves, and A. C. Dunningham. Middlewich, Cheshire. Eng. Pat. 12,599, Sept. 2, 1915.

In the manufacture of sodium thiosulphate from sodium sulphite and sulphur, the latter and the water are used in such proportions that they yield a thiosulphate solution which can be at once crystallised without evaporation. By using a small or a large excess of either material, or of both, the time of digestion is reduced by about one-half, and the excess can be used over again after removal and washing. Excess of sulphite remains undissolved in the concentrated thiosulphate solution. If an excess of sulphite and of sulphur be used alternately, the excess of soluble and insoluble impurities can also be removed alternately. The process may be rendered continuous by passing a hot solution of sulphite through an intimate mixture of solid sulphite and sulphur; and it may be accelerated by adding small amounts (about 1% by bulk) of hydroxides or sulphides of alkali or alkaline-earth metals, any excess of sulphide or polysulphide being afterwards removed by treatment with sulphurous acid or bisulphite. Instead of sodium sulphite, hydrated carbonates, or a mixture of anhydrous and hydrated carbonates, together with sulphur dioxide or sodium bisulphite may be employed.—E. H. T.

Nitre cake; Utilisation of—J. Grossmann, Manchester. Eng. Pat. 12,832, Sept. 8, 1915.

CAUSTIC soda and purified sodium sulphate are obtained from nitre cake by the following series of reactions:—I. $(3\text{Na}_2\text{SO}_4 + \text{H}_2\text{SO}_4) + 2\text{CaSO}_4 = 2\text{NaHSO}_4 + 2\text{CaSO}_4 + 2\text{Na}_2\text{SO}_4$. The calcium sulphate is removed, and lime is added with agitation: II. $2\text{NaHSO}_4 + 2\text{Na}_2\text{SO}_4 + \text{Ca}(\text{OH})_2 = \text{Na}_2\text{SO}_4 + \text{CaSO}_4 + 2\text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$. The calcium sulphite is removed and more lime added:—III. $\text{Na}_2\text{SO}_4 + \text{CaSO}_4 + 2\text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O} + \text{Ca}(\text{OH})_2 = 2\text{NaOH} + 2\text{CaSO}_4 + 2\text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$. During reactions II. and III. (which may be combined in one operation), heat may be applied and also an augmented pressure. The calcium sulphite is removed, washed, and used over again; the caustic liquor is evaporated until the sodium sulphate crystallises out, and after its separation, the liquid is further evaporated, if necessary, to dryness. The apparatus for I. is a leaden tank

provided with a cover and a stirrer; that for II. and III. is similar, but means for applying heat is added. (See also this J., 1916, 155.)—E. H. T.

Mineral silicates; Method of treating—[Extraction of aluminium and potassium.] J. C. W. Frazer, W. W. Holland, and E. Miller, Baltimore, Md. U.S. Pat. 1,196,734, Aug. 29, 1916. Date of appl., May 10, 1916.

ALUMINIUM and potassium are extracted from felspar or other mineral silicates by heating a dry intimate mixture of the silicate with caustic alkali to between 185° and 300° C., treating the product with water to remove the soluble alkali silicate formed, and extracting the residue first with an amount of acid equivalent to the water-insoluble alkali silicate which it contains, and afterwards with an amount of acid equivalent to the aluminium. The latter extract is evaporated to dryness, heated, and treated with water, to separate the soluble aluminium salt from the insoluble silica.—F. Sp.

Alkali-metal compounds; Process of extracting—H. B. Slater, Riverside, Cal. U.S. Pat. 1,197,550, Sept. 5, 1916. Date of appl., May 16, 1912.

A MINERAL containing potash is leached with a solution of ferric chloride containing an oxychlorine compound, such as hypochlorous acid. When iron is present in the mineral the leaching solution may be prepared by first extracting it with hydrochloric acid, electrolysis the resulting solution in the presence of sodium chloride, so as to produce ferric chloride and a cathode liquor containing sodium hydroxide, and then further electrolysis in presence of some of the cathode liquor.—F. SODN.

Magnesium chloride [and precipitated calcium carbonate]; Process of making—R. C. Lord, Cincinnati, Ohio. U.S. Pat. 1,197,512, Sept. 5, 1916. Date of appl., Oct. 15, 1915.

GAS containing less than 30% of carbon dioxide is passed through a scrubber in which it is exposed to a suspension of magnesium hydroxide in calcium chloride solution, which preferably gravitates as a counter-current through the interstices of broken filling material in the scrubber.—F. SODN.

Cobalt oxides; Electrolytic process for the extraction of—K. S. Gulterman, New York. U.S. Pat. 1,195,211, Aug. 22, 1916. Date of appl., Aug. 26, 1915.

A SOLUTION containing a soluble chloride and nickel and cobalt salts is electrolysed, and during the action the electrolyte is passed downwards over the anode, at a velocity permitting the retention of the liberated chlorine as a hypochlorite. The latter reacts with the cobalt solution, in the presence of an agent preventing the formation of free acid in the solution.—B. N.

Hydrogen peroxide; Manufacture of—F. Cobellis, Philadelphia, Pa. U.S. Pat. 1,195,560, Aug. 22, 1916. Date of appl., Aug. 23, 1915.

HYDROGEN peroxide is produced by the decomposition by heat of ammonium persulphate in a solution containing ammonium persulphate and bisulphate. The process is applied continuously by electrolysis a solution of ammonium sulphate at a comparatively low temperature, so as to form ammonium persulphate, heating the solution under pressure in order to form ammonium sulphate and hydrogen peroxide, and finally distilling off the hydrogen peroxide under reduced pressure in a current of inert gas. The residual solution of ammonium sulphate can then be put through the same cycle of operations again.—F. Sp.

Hydrogen; Manufacture of pure—E. B. Maxted and G. R. Ridsdale, Walsall. Eng. Pat. 12,698, Sept. 4, 1915.

HYDROGEN prepared by passing steam over heated iron previously reduced from its oxide in a current of water-gas, or other commercial reducing gas, contains considerable quantities of carbon monoxide, due to the deposition of carbon during the reduction and its subsequent oxidation by the steam. Hydrogen free from carbon monoxide is obtained by employing for the reduction of the iron oxide a reducing gas containing substantially more carbon dioxide than carbon monoxide, a suitable ratio being 2:1. This may be obtained by adding carbon dioxide to water-gas, or by suitable modifications in the manufacture of the reducing gas, but dilution of the gas with nitrogen (e.g., by partial combustion of the gas with air) or by steam must be avoided. The presence of carbon dioxide in the reducing gas prevents the deposition of carbon during the reduction of the iron oxide to iron, and therefore no carbon monoxide is formed when steam is passed over the heated iron to produce hydrogen.—F. Sp.

Alkali-metal compounds [sodium amide]; Process for the manufacture of—E. A. Ashcroft, London. U.S. Pat. 1,197,329, Sept. 5, 1916. Date of appl., Mar. 12, 1912.

SEE Eng. Pat. 1002 of 1912; this J., 1913, 232.

Utilisation of Mond gas and recovery of by-products [ammonium nitrate] therefrom. Eng. Pat. 14,391. See IIIA.

VIII.—GLASS; CERAMICS.

Refractive index and dispersion of glass in lenticular and other forms; A new method of measuring—R. W. Cheshire. Phil. Mag., 1916, 32, 409–420.

THE methods commonly used for accurately determining the refractive index of glass require the material to be in the form of a prism. When the glass is lenticular it is also possible to measure the focal length, the radii of curvature, and the axial thickness at the vertex, but with small lenses this method is not accurate beyond the third decimal place. A new method consists in immersing the glass in an aqueous solution of mercury potassium iodide, the refractive index of which is adjusted until it agrees with that of the test-piece, and then determining the refractive index of the liquid in a refractometer. The accuracy of this method is sufficient to give five significant figures. Light from a sodium flame illuminates a straight edge in a slit 1 mm. wide, an image of this edge being projected through a telescope objective into the plane of a second straight edge which is placed in front of an observing telescope. The glass to be tested and the immersion fluid are contained in a small rectangular glass cell having a carefully planed base plate, 2 mm. thick, made of extra dense flint glass for which $n_D = 1.74$, and closed above by an air-tight plate to prevent evaporation and the formation of striae. The cell is adjusted on the prism of a refractometer in the usual manner so that the refractive index of the liquid may be rapidly determined. The cell is placed between the objective and the observing telescope and the latter is focussed on the test-piece. If the refractive indices of the test-piece and the fluid differ, the image of the first straight edge will appear double, and on traversing the second straight edge slowly across the field of vision of the observing telescope the surface of the test-piece will gradually darken whilst the

side facets and the rest of the cell will show up brightly. On continuing the movement of the straight edge, these facets will also begin to darken until the whole field is black. When the refractive indices of the liquid and the test-piece are identical, the movement of the straight edge will cause the whole field to darken simultaneously and uniformly.

It has not been found possible to determine the refractive indices of glass for lines other than the D (sodium) line with the same degree of accuracy, but good results may be obtained by using coloured filters for lines C and F, and a mercury vapour lamp or a cadmium arc for measurements of partial dispersions.—A. B. S.

Quartz glass apparatus for bacteriological and surgical work. T. Paul. Münch. med. Wochenschr., 1916, 63, 1260. Chera-Zeit., 1916, 40, Rep., 318.

PIPETTES, graduated flasks, and other measuring apparatus made of clear quartz glass are recommended particularly for bacteriological work and for the preparation of sterile solutions, as they may be rinsed and then immediately placed in a gas flame and sterilised. Quartz glass apparatus is also useful for storing metallic colloid suspensions which would be spoiled by withdrawing alkali from ordinary glass. For the production of specially pure distilled water a retort and condenser made of quartz glass are recommended.—A. B. S.

PATENTS.

Glass-melting receptacles. S. R. Scholes, Pittsburgh, Pa., U.S.A. Eng. Pat. 101,393, May 5, 1916. (Appl. No. 6490 of 1916.)

A GLASS-POT made of the customary mixture of raw clay and burned clay, with or without ground pot shell, and preferably containing about 1% of alkali, is lined with a similar mixture containing 2% of alkali, preferably in the form of felspar.—A. B. S.

Refractory articles; Manufacture of—T. B. Allen, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,197,327, Sept. 5, 1916. Date of appl., Nov. 29, 1913.

REFRACTORY silicon carbide articles are manufactured by incorporating ferric chloride solution with a mixture of silicon carbide and clay, then shaping the article and firing at a temperature sufficient to decompose the ferric chloride. The resulting iron oxide is vitrified with the clay, at or adjacent to the surface.—B. N.

Refractory [material]; Corrosion-resisting—P. R. Hershan, Chicago, Ill. U.S. Pat. 1,198,033, Sept. 12, 1916. Date of appl., Aug. 9, 1915.

A REFRACTORY material which resists corrosion is made of aluminous material and carbon, the latter being in too small a proportion to convert the whole of the aluminium into carbide. The material is burned at a temperature sufficiently high to render it inert to hydrofluoric acid.—A. B. S.

Firebricks; Composition of matter for making—Plastic composition [for sewer-pipe, tiles, etc.]. E. V. Wagner, Scranton, Pa., Assignor to The Wagner Fire Brick Co., Helena, Mont. U.S. Pats. (A) 1,198,171 and (B) 1,198,172, Sept. 12, 1916. Date of appl., Jan. 8, 1916.

(A) A MIXTURE of coal-ash 100 lb., magnesia 3 lb., water 2–2½ gallons, is used for making firebricks. (B) A mixture of coal-ash 0.98 cb.yd., crude fibrous asbestos 0.01 cb.yd., soluble sodium silicate 0.01 cb.yd., and water 30–35 galls. is mixed, moulded, and burned to form sewer-pipes, tiles, etc.—A. B. S.

IX.—BUILDING MATERIALS.

Ammonium salts; Use of solutions of — for the treatment of wood. F. Moll. Z. angew. Chem., 1916, 29, 339—341.

AN outline, with lists of patents, is given of the different processes of treating wood with ammonium salt solutions. Their only value as preservative agents is to protect wood against fire; for this purpose the sulphate and phosphate are most frequently employed. Ammonia is also of value as a mordant for staining wood and for the extraction of resins. For other purposes the activity of ammonium salts is too slight to be of value.—C. A. M.

PATENTS.

Drying and extracting [wood]; Process of —. D. B. Banks, Baltimore, Md. U.S. Pat. 1,197,097, Sept. 5, 1916. Date of appl., Apr. 19, 1915.

To separate liquids or fusible substances from cellular, fibrous, or porous substances, e.g. wood, the latter is heated in an enclosed shell with saturated steam to the boiling point of the liquids at the pressure of the steam, preferably in presence of substances which more readily absorb and radiate heat. The pressure and temperature of the steam is continuously lowered so as to produce internal evaporation in the cellular substances until the liquids have been expelled. The condensed products are removed from the shell, and the wood dried and seasoned by maintaining an atmosphere of superheated steam in contact with it.—W. F. F.

Wood; Process of treating and preserving —. A. F. Barry, Kansas City, Mo. U.S. Pat. 1,197,997, Sept. 12, 1916. Date of appl., Apr. 19, 1915.

CASE-HARDENED and non-porous wood is heated *in vacuo* and supplied with a predetermined amount of water vapour below 100° C. in such a manner that the vapour penetrates the wood uniformly without breaking the vacuum or "checking" the wood. The wood is then treated with a hot preserving oil and air admitted under pressure to distribute the oil through the wood.—A. B. S.

Wood; Impregnated — and process of making the same. M. Landau, Berlin. U.S. Pat. 1,198,040, Sept. 12, 1916. Date of appl., Nov. 13, 1914.

Wood is impregnated with polynitrophenols in which the hydrogen of the phenol groups has been replaced by non-basic, non-aromatic organic groups.—A. B. S.

Manufacture of sulphuric acid [and cement]. U.S. Pat. 1,197,331. See VII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron; Polymorphic transformations of pure —. R. Ruer and F. Goerens. Ferrum, 1915, 13, 1—6. J. Chem. Soc., 1916, 110, ii., 483—484.

ELECTROLYTIC iron, containing only 0.009% of carbon, was used for the determinations, after being melted in a porcelain tube in nitrogen. By means of a platinum-wound electric resistance furnace, thickly insulated with asbestos, the rate of cooling over a given temperature interval was varied within wide limits. In order to prevent oxidation, the mass of iron was enclosed in a porcelain test-tube and covered with broken porcelain to the top of the tube, and a slow stream of nitrogen was introduced by means of a gas-tight joint. The iron was found to freeze at 1528° C., and to undergo the γ - δ -transformation at 1401° C. The temperature of the β - γ -equilibrium was

906° C., determined by comparing the heating and cooling curves at different rates. In the same way, the temperature of the α - β -equilibrium was determined to be 769° C. There was no evidence of a change between 1000° and 1200° C., the development of heat sometimes observed within that range being due to the presence of oxide.

Carbon steels; Determination of the α - β -transformation in pure — by means of the thermal expansion. J. Driesen. Ferrum, 1915, 13, 27—31. J. Chem. Soc., 1916, 110, ii., 484.

ON plotting the change of length for a given interval of temperature, $L_2 - L_1/t_2 - t_1$, against the temperature, characteristic curves are obtained which are well suited to exhibit any discontinuities which may present themselves in the expansion of a steel. All the steels examined, ranging from 0.05 to 1.45% C, give an almost horizontal line at low temperatures, followed by a rapid fall, which reaches a minimum at 745° C. This corresponds with the conversion of the pearlite into a solid solution. The steels containing less than 0.40% C then exhibit a well defined maximum at 765°—775° C. corresponding with the α - β -transformation. The maximum which follows indicates the beginning of the β - γ change. Steels containing more than 0.4% C give curves with only a single depression, due to the pearlite change.

Steel; Influence of some elements on the mechanical properties of —. J. E. Stead. Iron and Steel Inst., Sep., 1916. [Advance proof.] 91 pages.

Influence of carbon. The results obtained by different investigators in determining the influence of varying amounts of carbon and of varying heat treatment on the mechanical properties of pure carbon steels are summarised. Comparison is difficult owing to the fact that in some cases the dimensions of the test-pieces submitted to tensile tests are not always given. It is suggested that when recording the elongation, the ratio of length to area should invariably accompany the figures, for without this the percentages of elongation are of little value. The yield point is often given as the elastic limit, yet the latter may be in some cases only half the former. When using the terms normalising or annealing, the temperature of heating and the time of cooling to below visible redness should be recorded. Neither term should be used without definition. After allowing for the influence of the small amount of carbon present in the purest commercial soft steels, it has been calculated that pure iron has the following properties:—elastic limit about 9 tons per sq. in.; maximum stress 17 tons per sq. in.; elongation (length/area = 8) 51%; reduction in area 84%. The effect of 0.1% C on very pure steels containing less than 0.9% C, with only small amounts of manganese and silicon, and in the normalised condition, appears to be:—yield point increased 1.68 tons per sq. in.; maximum stress increased 3.89 tons per sq. in.; elongation reduced 4.35%; reduction of area reduced 7.40%. In the manufacture of ship and boiler plates the carbon must be higher in the thicker plates to get the same static tests, since the more work, and the lower the finishing temperature, the higher will be the tenacity. *Normalising.* When steel is heated to definite temperatures well above all critical points, the carbon and iron become perfectly interdiffused. If then the steel cools down from the maximum temperature to below redness (say 450° C.) in not more than sixteen and not less than eight minutes it may be regarded as normalised. Published results lead to the conclusion that when small pieces of steel are normalised by heating just up to 870° C. and 950° C., and then cooled in air to about 400° C. in ten minutes, high yield point and tenacity are obtained without material reduction in the

ductility. In normalising large steel castings it is the general practice to heat to about 900°C , but it is clear that the tests of small pieces of steel cast in connection with large castings will not indicate the properties of the larger mass. To obtain the best static mechanical properties it is not sufficient to heat a steel to just above the point at which cooling records and the microscope indicate the interdiffusion of carbon and iron to be apparently complete, but the temperature must be raised at least 50°C beyond that point. *Hardening and tempering.* The best all round results obtained by Brinell with Swedish steels containing 0.18 to 0.44% C were got by quenching from 1000°C in water at 20°C , and afterwards tempering at 650°C . A steel with 0.65% C gave the best results by quenching at 850°C in oil. There would be great danger of water-cracking if large masses were quenched from 1000°C in water; oil quenching at 1000°C for low carbon steels, and 850°C for steels with 0.3 to 0.65% C, followed by tempering, would be safer, and it is probable that better results would be given by quenching from 900°C . For low carbon steels with 0.2 to 0.4% C, it is safe to heat to, but not soak at, 900° to 950°C before quenching and tempering, and to heat to gradually lower temperatures as the carbon rises. When hardening plain carbon steels for cutting purposes, the quenching temperature should never exceed a few degrees above the critical point $\text{Ac } 1-2-3$, that is, about 730°C . For hardening razors and fine cutting tools, the theoretical point to which they should be heated is 735° to 740°C , but in practice it is found safer to exceed this, though it is not usual to heat such material above 760°C . Carbon tool steels if quenched from 900° – 1000°C would be useless for cutting purposes, and would have a glaring coarse fracture when broken, and be exceedingly fragile, yet steels with 0.6 to 1% C give good mechanical results if hardened at 1000°C and afterwards tempered at 550°C . Tests have shown that steels normalised at temperatures that give the finest structure have a lower yield point than steels that are normalised at much higher temperatures and which have a coarser structure. The temperatures suitable for hardening and refining are, therefore, lower than those best for normalising, and for hardening and tempering. Curves are given showing the temperatures to which, theoretically, in the author's opinion, pure carbon steels should be heated (1) to obtain the finest structure and for hardening tools, and (2), when heated for oil hardening and tempering to get the best mechanical properties. *Influence of phosphorus.* The effect of phosphorus, within certain limits, appears to be comparable with that of carbon, but the effect of carbon is the greater in reducing the ductility. The effect of 0.1% P as determined by Stead and d'Amico respectively is:—yield point raised 2.5 and 2.3 tons; maximum stress raised 2.4 and 4.1 tons; elongation reduced 0.7 and 1.30%; reduction reduced 1.5 and 3.8%. A certain amount of carbon (about 0.25 to 0.35%), when present in steel containing 0.2 to 0.5% P, causes the steel in setting to be much more finely crystalline than when phosphorus is absent, but the reverse is the case when little or no carbon is present. In the forged steels the crystalline structure is usually the finer in the phosphoretted steel. There is no reliable record showing that sound steel rails containing from 0.07 to 0.09% P break on the track more frequently than those containing less phosphorus. Phosphoretted rails undoubtedly resist wear better than the similar rails with less phosphorus present. Phosphoretted steel is most useful in small amount in tin-plate bars, as it prevents the sheets sticking together during rolling, and it is used in larger quantity in low carbon steel for bicycle parts. It confers on steel the important property of giving clean and

bright surfaces when turned in the lathe, and moreover increases the elastic limit and tenacity. The quantity required to give good machining property is usually from 0.13 to 0.20%. Phosphorus alloyed with iron makes the metal less liable to corrode, and in that respect is useful. Probably the great variations in the mechanical properties of phosphoretted material can be explained by the difference in structure, for it has been proved that the same steel or iron can be made very brittle or comparatively tough according to whether the structure has been made fine or coarse. It is much more important to have a fine structure in phosphoretted material than it is in ordinary steel low in phosphorus. *Phosphorus in wrought iron.* Although wrought iron containing 0.4 to 0.5% P is liable to develop dangerous crystallisation if highly heated, and in the neighbourhood of welds, the presence of 0.10 to 0.15% P does not lead to that result. The best Yorkshire and Staffordshire irons contain phosphorus between these lower limits, and for structural purposes are superior to the best Swedish wrought irons, as the phosphorus in the former raises the elastic limit and makes the iron more easy to weld, and gives a higher yield point and tenacity. Carbon being always low, the phosphorus takes its place in conferring on the iron these useful properties. When the phosphorus reaches 0.4 to 0.5% the iron becomes brittle, and it is impossible to refine the coarse crystalline structure by heat treatment. Refining of the iron can only be effected by forging. *Influence of sulphur and manganese.* Sulphide of iron is deadly in its effect upon steel, whilst sulphide of manganese is comparatively harmless. The latter is exactly equivalent to the cinder in wrought iron, and in consequence steels containing it bend to a much greater extent in the direction of rolling than at right angles to that direction. The bad character of sulphur was earned in the early days of steel making owing to the difficulty of getting a sufficient quantity of manganese into the steel without unduly raising the carbon. In a most exhaustive series of tests made by Brinell a steel with 0.15% S gave the best impact tests, better far than a similar steel containing only 0.015% S. A steel containing 0.5% S and 1% Mn rolled and worked perfectly. When steel becomes stressed transversely to the rolling direction in use, the sulphur should be low, but when it is stressed in line with the rolling direction, as in rails and axles, and for material that has to be submitted to sudden shock, sulphur is not a disadvantage. Steel high in sulphur resembles wrought iron and is more or less fibrous. The more sulphurous a steel, other conditions being constant, the more rapidly is it attacked by acid solvents, owing to the great solubility of the manganese sulphide. After the threads of the latter are dissolved away, the acid attacks the walls of the holes so produced. The so-called porosity test, in which cross-sections of steel are immersed in acid for a given time, is a suitable one for roughly detecting sulphur, but not porosity. It is possible that high sulphur may be conducive to increased corrosion by the oxidation of the manganese sulphide to oxides of manganese and sulphuric acid, the acid formed then attacking the iron. *Influence of silicon.* The effect of silicon up to about 0.7% is not very pronounced either one way or the other, and it is doubtful whether any difference could be detected in steels varying in silicon between 0.05 and 0.30%. Silicon produces soundness in cast steel and on that account is now largely used. Owing to its use, also, basic open-hearth steel now approaches more nearly in good general properties to acid open-hearth steel than before silicon was added. Silicon up to 1.75% increases the yield point and tensile strength, and does not impair the ductility, but beyond that point increase of tenacity is only obtained with a serious loss of ductility. *Influence*

of copper. The evidence is overwhelming that small quantities of copper, say about 0.5%, have little or no material influence on the mechanical properties of steel. What small effect copper has is in its favour. It raises the yield point and tensile strength and has little effect on the ductility. Some of the finest tool steel ever made contained 0.2% Cu. Even small quantities of copper make steel more resistant to acid corrosion, and there is much evidence that copper in steel sheets preserves them from general corrosion. *Influence of tin.* Sensible quantities of tin increase the hardness of steel when heated and also increase the yield point and maximum stress of the cold metal, but have not nearly so great an effect as carbon and phosphorus. It is doubtful whether 0.05% Sn would have any material influence on the properties of structural steel. Detinned scrap should not contain more than 0.5% Sn as a maximum. Results of tests show that tin in sensible quantity must be avoided, as it tends to make steel very difficult to roll, and hard and stiff when in the heated state. A bibliography is appended.—T. St.

[Steel.] *Pearlite*; Notes on —. H. M. Howe and A. G. Levy. Iron and Steel Inst., Sept., 1910. [Advance proof.] 23 pages.

TEST-PIECES of a steel containing C 0.92, Si 0.14, Mn 0.123, P 0.009, S 0.011% were heated to a predetermined temperature, usually 800° or 900° C., and cooled immediately at a predetermined rate, which varied from case to case from that of a greatly retarded furnace-cooling to that of quenching in cold water. The effects of these variations on the position, length, and rise of Ar₁, and on the properties and microstructure of the steel were studied. Hastening the cooling lowers that part of the Ar₁ retardation at which the heat evolution is fastest, from the equilibrium position of about 725° C. at least to 625° C. if not to 530° C. Raising the initial temperature from 800° to 900° C. lowers Ar₁ slightly, about 5° C. Hastening the cooling at first increases the rise of temperature in Ar₁, but later lessens it. Thus with very slow cooling and consequently an extremely long Ar₁, the rise of temperature is either nil or at most 1° or 2° C.; when Ar₁ is shortened to about 5 minutes, a rise of as much as 4° C. may occur; with further acceleration of cooling, as in retarded air-cooling, the rise of temperature may reach 18° C., and finally with still further acceleration, as when cooling in a blast of air or in water, the rise decreases in turn to nil. On the whole, for a given rate of cooling, the rise of temperature is greater when cooling from 900° C. than from 800° C. These variations are explained by the higher temperature and longer period of the initial heating tending to impair and destroy the existing transformation-starting nuclei, and by the undercooling brought about by quick cooling. Moreover, the faster the temperature is falling, the farther will it have fallen (after the transformation has begun) when the spread of the transformation has reached such a degree that the heat generated is sufficient measurably to retard the cooling. The greater the undercooling below Ar₁, the greater is the impulse to transform from the high to the low-temperature state; hence the greater is the number of points or nuclei at which this tendency is so strong that they start transforming, and hence (1) the faster does the transformation occur, and (2) the greater is the tendency to raise the existing temperature towards Ar₁. When, however, the faster heat evolution is brought about by more rapid cooling, the more rapid external heat absorption which this in turn implies, tends to counteract the raising of the temperature. The following stages in the progressive change in the microstructure brought

about by changing the rate of cooling may, it is considered, be recognised with advantage:—martensite, troostite, osmondite, sorbite, sorbitic pearlite, sub-lamellar pearlite, lamellar pearlite, reefy pearlite, beaded pearlite, and granular pearlite. The authors propose to restrict "sorbite" to structures irresolvable under a magnification of 500 diameters, and to those in which the transformation is complete, so that no allotropic iron or hardening carbon is present. The grounds on which the suggested nomenclature is based are discussed. The rate of cooling from 650° C. down does not affect the microstructure or the tensile properties unless the cooling as far as 650° C. has been at least relatively rapid. With very slow cooling to 650° C. the opportunity for coalescence is so great that the additional opportunity afforded by very slow cooling below 650° C. is inappreciable, but with quick cooling above 650° C., followed by slow cooling, the additional opportunity for coalescence causes a measurable softening. The formation of lamellar pearlite is caused by an intermediate rate of cooling, slow enough to permit the lamellae to form, yet not so slow as to allow them in turn to granulate. The rates of cooling which give and preserve lamellar pearlite are much greater when the preliminary temperature is 800° C. (20 seconds duration Ar₁), than when it is 900° C. (11 to 18 minutes for Ar₁). Lamellar pearlite formed on cooling from 900° C. is coarser and more stable than that formed by cooling from 800° C. The microstructure is in all cases determined by the last heating and cooling past Ar₁. Every increment of the rate of cooling increases the strength and lessens the ductility. Unless the rate of cooling is rather rapid, the tensile strength of specimens cooled from 800° C. is far less than that of those cooled from 900° C. This probably results from the greater instability of the pearlite produced on cooling from 800° C., "divorce" beginning when Ar₁ lasts 35 seconds and being almost complete when it lasts 80 seconds. Specimens cooled from 800° C. are far more ductile than those cooled from 900° C. and their proportional limit is not deficient as is their tensile strength. These effects are referred provisionally to the finer structure of the former specimens. It is probable that long exposure to 800° C. would lead to the structural stability conferred by a brief exposure to 900° C.—T. St.

Manganese [in steel]; Rapid determination of —. E. Szász. Chem.-Zeit., 1916, 40, 810—811.

FOR the determination of manganese in steel the method of Meineke has almost fallen into disuse, yet in spite of the large number of reagents and vessels required, it is extremely simple in operation, and gives a result in 12—15 mins., which is sharp and accurate and unaffected by other metals present in the steel, with the exception of cobalt. The steel is dissolved rapidly in a mixture of nitric and sulphuric acids, chromic acid is added, a suspension of zinc oxide in barium chloride solution is added to the diluted solution, and an aliquot portion of the filtered liquid taken. In a separate vessel some zinc chloride solution and a calculated excess of standard permanganate are measured out and the portion of the filtrate from the steel poured in so that the permanganate is in excess throughout; the mixture is made up to a known volume and another aliquot portion filtered off. This filtrate is added to a measured excess of standardised antimony chloride solution in presence of hydrochloric acid; the permanganate is thus discharged, and the excess of antimony is determined by titration with permanganate. A correction has to be determined and applied to correct for the consumption of permanganate by the filter paper during filtration.—J. F. B.

Platinum and illuminating gas. F. Mylius and C. Hüttner. *Z. anorg. Chem.*, 1916, **95**, 257—283. *Z. angew. Chem.*, 1916, **29**, Ref., 396.

COAL gas has an injurious action on commercial sheet platinum even at 600° C., a sooty layer containing metal being formed. If the carbon be removed from this layer by combustion, the metal is left behind in a porous form. Synthetic illuminating gas (a mixture of methane, ethylene, carbon monoxide, and hydrogen) has no action on sheet platinum or platinumiridium at 600° C. The injurious action of coal gas is due to carbon bisulphide which combines with platinum metals to form unstable compounds. The formation of the sooty layer on platinum in heated coal gas is greatly influenced by impurities in the platinum, especially iron and rhodium, and may be used as a qualitative test to distinguish pure and impure platinum; with rhodium interaction with the coal gas begins at about 100° C. Luminous flames act in a similar manner to heated coal gas, but flames with an abundant supply of air have only a slight injurious action, the only appreciable effect, in the case of pure platinum, being a slight volatilisation of the metal. To minimise corrosion of platinum vessels heated in gas flames, a high sulphur content in the gas must be avoided and the flame must be provided with an abundant supply of air. (See also this J., 1915, 853; 1916, 740.)—A. S.

Blendes; The roasting of— M. V. M. de Lummen. *Chem. Trade J.*, 1916, **59**, 261—262. (See also this J., 1916, 425.)

The relative merits of the Delplace, Hegeler, and Spirlet furnaces for roasting blende are considered, and the following particulars given of the plant required for roasting 40 tons of Australian concentrates per 24 hrs. by each system, and of the respective operating costs. The prices given for the installations are based on those ruling before the war; and the operating costs on wages at 5s. per man per day, fuel at 10s. per ton, power at 0.7d. per horsepower-hour, and an allowance of 15% for depreciation and interest on capital. *Delplace*: Cost of 3 batteries of furnaces (14 tons per day each), including buildings, accessories, and royalty, £9000. Labour, 50 men and 2 foremen. Fuel consumption, 12% of the weight of raw ore. Power, nil. Total cost of roasting per ton of ore, 10s. 3½d. *Hegeler*: Minimum cost of furnace, including £3000 for building and accessories, £15,000. Labour, 20 men and 2 foremen. Fuel consumption, 30%. Power, 35 H.P. Total cost of roasting per ton of ore, 12s. 3½d. *Spirlet*: Cost of 9 furnaces (5 tons each), including royalty and £2000 for building and accessories, £13,520. Labour, 16 men and 2 foremen. Fuel consumption, 10%. Power, 16 H.P. Total cost of roasting per ton of ore, 8s. 6½d.—W. E. F. P.

Brass containing 61 and 62.5% of copper; Annealing of arsenical— A study of the structure and properties developed by varying the rate of cooling within the transformation range. C. H. Mathewson and E. M. Thalheimer. *Inst. of Metals*, Sep., 1916. [Advance proof.] 48 pages.

TESTS were made for the purpose of selecting a brass mixture based on the use of copper containing about 0.3% As, and of specifying forms of heat treatment which would give satisfaction in the manufacture of heavy tube. The process was to involve hot-rolling a thick cake to a circular disc about one-half inch thick, annealing and then cupping the disc, after which tube was produced by a number of closing in and drawing operations, each preceded by annealing treatment. The mixture selected contained 62.5% Cu, and therefore not more than 0.16% As. Results of tests are given showing the properties of brass con-

taining (1), 62.5% Cu and only 0.024% As, (2), 62.5% Cu and 0.12% As, and (3), 61% Cu and 0.139% As, after different forms of heat treatment. After annealing and quenching the first two alloys at a variety of temperatures between 450° and 750° C., greater elongation and greater strength were consistently obtained in the case of the arsenical brass. After annealing and quenching at 550° C., the temperature which developed maximum values of elongation and minimum values of tensile strength in both cases, the arsenical brass possessed an elongation of 77.5% on 2 inches, and a tensile strength of 49,300 lb. per sq. in., while the non-arsenical metal possessed an elongation of 74.25%, and a tensile strength of 48,300 lb. The ductility of the arsenical brass was more adversely affected by annealing at high temperatures followed by immediate cooling at a quenching rate, but a perfect recovery of ductility took place if the cooling was reasonably slow, even when slow cooling was superseded by quenching at a dull red heat. The arsenical alloy with 61% Cu gave lower elongation and higher tensile strength throughout than that with 62.5% Cu and 0.12% As. The results are considered to show that the arsenical metal is likely to afford a better combination of strength and ductility than metal made from electrolytic copper, when both are properly annealed, and that arsenical brass of this type will meet severe hot- and cold-working requirements. To obtain the most favourable conditions for cold-working a brass with 61% Cu, annealing, if conducted at temperatures above moderate red heat, should be followed by at least a moderately slow rate of cooling, say 20° C. per minute, and slow cooling should be continued to a temperature not far above 450° C. For a metal with 62 to 63% Cu, emphasis should be laid on very slow cooling; for example, a 5° rate is far more satisfactory than a 20° rate, and in such case the metal should be allowed to cool normally to about 550° C., when it may be quenched in a stream of water. For a rate of cooling in excess of 20° C. per minute, it is advantageous to allow such cooling to proceed unchecked to 450° C., or even a lower temperature.—T. ST.

Nickel ores; Occurrence and utilisation of— Bull. Imp. Inst., 1916, **14**, 228—253.

THE chief nickel minerals occurring in commercial nickel ores are briefly described, and statistics given of the production, during recent years, of ore and matte in Canada, New Caledonia, and Norway, the chief producing countries. Thus, in 1911 the quantity of copper-nickel ore mined in Canada was 612,511 short tons, of which 610,834 was smelted, with the production of 32,607 short tons of matte valued at £1,030,332 and containing 8966 and 17,049 short tons of copper and nickel respectively; while out of 1,364,048 short tons of ore mined in 1915, 1,272,283 was smelted, producing 67,703 short tons of matte valued at £2,156,738 and containing 19,608 and 34,039 short tons of copper and nickel respectively. The matte, etc., exported from Canada to the United Kingdom and the United States in 1911 contained 2512 and 13,798 short tons of nickel, respectively, the corresponding figures for 1915 being 6874 and 26,331 short tons. The quantity of nickel ore produced in New Caledonia increased from 150,005 metric tons in 1911 to 172,365 in 1914; the exports in 1911 being 147,060 metric tons of ore, valued at £176,472, and 3859 of matte valued at £107,492, and the exports in 1914, 94,154 metric tons of ore and 5364 of matte valued at £109,219 and £128,736, respectively. The quantity of nickel ore produced in Norway increased from 5770 metric tons in 1909 to 49,990 in 1913. Geological and other particulars are given of the occurrence of nickel ores in Canada,

United States, Cuba, United Kingdom, Austria-Hungary, Germany, Italy, Norway, Russia, Spain, Sweden, Switzerland, Union of South Africa, Nyasaland, Madagascar, Tasmania, New South Wales, New Caledonia, and India. Nickel is used chiefly in the form of alloys, of which the most important is nickel steel; the latter (2.5–3.5% Ni) having a much higher elastic limit and greater tensile strength than ordinary steel, and on this account being employed extensively in bridge building, naval and military armaments, etc. The strongest of the nickel steels contains 13% Ni and is so hard as to be unmachinable. Nickel is also used in conjunction with chromium for the manufacture of special steels which, for the same strength, are more cheaply produced than nickel steels. In this connection, the ore mined at Mayari, in Cuba, is of special interest; by direct smelting, this ore yields a crude iron (containing 1.4% Ni and over 2.5% Cr) from which nickel-chromium steel is obtained. Other useful alloys are "invar," a nickel steel (Ni 36, C 0.2%) having a guaranteed coefficient of expansion as low as 0.000008; "platinite," a similar steel (Ni 40, C 0.15%) having about the same coefficient of expansion as glass and therefore used for fusing into the latter in place of platinum; the Cu-Zn-Ni alloys variously known as German silver, Nevada silver, etc.; Monel metal (Ni about 70, Cu about 30%) obtained by the direct smelting of copper-nickel matte; "constantan" (Ni 40, Cu 60%) and "manganin" (Ni 12, Cu 84, Mn 4%) used for electrical resistances; and cupro-nickel (Cu 85, Ni 15%) used in the United States for making bullet jackets. Vessels of pure nickel are used for laboratory purposes, and a considerable amount of nickel is employed in the form of nickel sulphate for electroplating. Pure nickel and nickel bronze are also used for coinage, and it has been estimated that, up to the end of 1912, 909,167,567 coins of pure nickel and 4,543,793,571 coins of nickel bronze (25% Ni) had been issued.—W. E. F. P.

Tungsten deposits in California. U. S. Comm. Rept., Sept. 11, 1916.

The tungsten deposits discovered in California in 1913 have recently commenced to yield considerable quantities of ore. The deposits are 8 miles west of Bishop, Inyo County. The mineral has been found in a belt 15 miles long, the lode in some places reaching a width of 60 feet. The ore bodies consist of scheelite associated mainly with garnet, epidote, and quartz.

Antimony trisulphide and the products obtained from it by roasting; Quantitative analysis of —. F. von Bacho. Monatsb. Chem., 1916, 37, 85–117. J. Chem. Soc., 1916, 110, ii, 496–497.

For the estimation of sulphur in antimony trisulphide, the substance is decomposed by boiling with 25% hydrochloric acid in an atmosphere of hydrogen and the hydrogen sulphide evolved absorbed by a 3–4% solution of sodium hydroxide. All the solutions should be air-free, and the alkaline sulphide solution should be added slowly, with continuous stirring, to an acidified solution of iodine, the strength of which should not exceed N/100. The bromate and iodine methods for the estimation of antimony give consistent results, but in both cases the quantities found by experiment are about 1% smaller than the theoretical amounts. This is in agreement with previous analytical experience, and since both methods yield results in agreement with theory if the older value of 122.0 is taken for the atomic weight of antimony, it is suggested that the atomic weight of antimony should be redetermined.

The product obtained by roasting antimony trisulphide is said to contain antimony tetroxide. In presence of this oxide, low values are obtained

when the sulphide is estimated by the method described above, and this is attributed to the oxidation of the hydrogen sulphide by the antimony tetroxide. Satisfactory results may be obtained if the substance is boiled with 25% potassium hydroxide, and the solution reduced by the addition of metallic aluminium, when the antimony is precipitated. The hydrogen sulphide is then liberated by the addition of acid and absorbed in 3–4% sodium hydroxide solution.

According to Rose, the tetroxide may be estimated by heating with excess of antimony trisulphide in an inert atmosphere, when sulphur dioxide is set free according to the equation $Sb_2S_3 + 9Sb_2O_3 = 10Sb_2O_4 + 3SO_2$. Experiments made by the author with mixtures of the trisulphide and the tetroxide which were heated in a current of carbon dioxide gave much larger quantities of sulphur dioxide than correspond with this equation. Further investigation has shown that the carbon dioxide is acted on by antimony trisulphide at a dull red heat with the formation of sulphur dioxide, carbon monoxide, and carbon oxysulphide. This reaction precludes the possibility of estimating the higher oxides of antimony by fusion with the trisulphide in an atmosphere of carbon dioxide. Since it has also been found that sulphur dioxide is formed by the interaction of the trioxide with the trisulphide in an inert atmosphere, it follows that the liberation of sulphur dioxide cannot even be used as a qualitative test for the presence of higher oxides in the products obtained in the roasting process.

Coal; Use of powdered — in metallurgical processes; a discussion of the engineering principles involved. C. J. Gadd. J. Franklin Inst., 1916, 182, 323–352.

DRIED powdered coal can be substituted economically and efficiently for producer and oil gas in heating puddling, heating, and open-hearth furnaces, with or without regenerative chambers. Only the best bituminous coals, high in volatile matter, and low in sulphur and ash are desirable. Coal used in heating and puddling furnaces should closely approximate to the composition:—volatile matter not under 30.00%, fixed carbon not under 50.00, moisture not over 1.25, ash not over 9.50, sulphur not over 1.00%; that for open-hearth furnaces to the composition:—volatile matter not under 30.00%, fixed carbon not under 52.00, moisture not over 1.25, ash not over 6.00, sulphur not over 1.00%. The dryer generally used for preparing coal before pulverising is of the revolving cylinder type, externally heated. To obtain high efficiency of combustion the coal should be powdered so that 95% will pass a 100-mesh sieve, and 83% a 200-mesh sieve. After pulverising, the moisture in the fuel should not exceed 0.75%. The whole system from the dryer to the furnace should be dust-proof, and the greatest care should be taken to prevent leakage. Powdered coal in storage, containing about 0.75% of moisture and 1% of sulphur, will invariably fire within six days. To meet ideal conditions, powdered coal should be kept in motion. The burners are operated under either low or high pressure. Low-pressure burners are used with an air blast varying from 2 to 8 oz.; high-pressure burners are used with compressed air varying from 40 to 100 lb. pressure. The low-pressure burners give a short flame, as the fuel burns almost the instant it leaves the burner; the high-pressure type produces a long flame through progressive combustion, and can be used only where the form of the furnace and the character of the work demand that an elongated cutting flame be developed in close proximity to the work done. The latter method is adapted to open-hearth furnace practice and ore nodulising. The results

are equally good whether the powdered coal is ejected from the burner at 1500 or 25,000 feet per minute. To ensure success the coal must be ground as finely as possible and fed to the furnace at an uniform rate, and the furnace must be so designed that complete combustion may take place while the coal is in suspension. In puddling furnaces the use of powdered coal has shown an average saving of about 30 to 36%, and in heating furnaces 15 to 25%. For every pound of coal fired, the waste-heat boilers show an evaporation of from 7 to 8 lb. of water. Details are given of plant comprising coarse coal storage, drying, pulverising, and conveying equipment, and different types of feeders and burners are described. The design of typical furnaces heated by powdered coal is shown by sectional drawings.—T. St.

Determination of zinc by Schaffner's method. Patek. See XXIII.

PATENTS.

Iron alloy rich in phosphorus; Process of producing an — from inferior finery-slag. F. von Holt, Osnabrück, Germany. U.S. Pat. 1,196,185, Aug. 29, 1916. Date of appl., June 26, 1916.

IRON slag containing 1–6% P, with or without manganese, is mixed with coal and the mixture "burned" in a gas generator at a temperature sufficient to effect combination between the basic constituents of the slag and the silicates present in the coal ash.—W. E. F. P.

Iron and steel [articles]; Method of changing the composition of —. B. Ford, Philadelphia, Pa. U.S. Pat. 1,196,787, Sept. 5, 1916. Date of appl., Jan. 27, 1914.

THE article is immersed in a suitable medium heated externally to a temperature below its decomposing point, and an electric current is passed through the article to heat it and decompose the medium locally and permit its absorption by the metal.—W. E. F. F.

[Chromium-steel.] Cutlery. H. Brearley, Sheffield. U.S. Pat. 1,197,250, Sept. 5, 1916. Date of appl., Mar. 6, 1910.

A HARDENED, tempered, and polished cutlery blade is composed of a ferrous alloy containing Cr 13.0%, Mn 0.30%, and C 0.30%, free from microscopically distinguishable free carbides.—W. E. F. F.

Mild steel, steel, or copper; Deoxidation of —. H. König, Crefeld. Ger. Pat. 293,470, Oct. 11, 1913. Addition to Ger. Pat. 290,309.

THE process described in the chief patent (this J., 1916, 544) is modified in that the carbon anode is raised somewhat above the surface of the molten metal, so that an arc is formed, and substances which combine with oxygen, e.g., carbon, silicon, titanium, molybdenum, are added to the molten metal.—A. S.

Furnace; [Zinc] smelting —. E. Ruck, Swansea. Eng. Pat. 8265, June 3, 1915.

TO allow the front ends of the retorts in the second and succeeding tiers of a regenerative gas-heated furnace for smelting zinc ores to be sufficiently heated, secondary gas and air supply conduits with suitable delivery outlets are provided in, for example, the front wall of the furnace structure. The mouths of the retorts are fixed close to the front wall of the furnace to facilitate charging and emptying.—T. St.

Furnace for metallurgical purposes, e.g., for the recovery of zinc. Coswiger Braunkohlen-Werke Ges.m.b.H., Coswig. Ger. Pat. 293,344, Feb. 16, 1915.

THE furnace is in the form of a shaft composed of

three parts, viz., a lower reduction chamber, an intermediate preheating chamber, and an upper feed chamber. A condensing chamber, with packing similar to that in a regenerator chamber, surrounds the shaft at about the level of the preheating chamber. The mixture of zinc vapour and carbon monoxide evolved in the reduction chamber is drawn by a fan or the like through the preheating chamber into the condenser, which is kept at about 500° C., so that the zinc is condensed in the liquid form. The carbon monoxide is drawn from the condenser by the fan and forced into the lower end of the feed chamber and escapes through an outlet at the top of the latter. By this method of working, the charge is preheated to about 500° C. in the feed chamber and to 900° C. in the preheating chamber, the reduction chamber being heated electrically or otherwise to 1200°–1300° C.—A. S.

Ores; Process for agglomerating —. F. Krupp Akt.-Ges. Grusonwerk, Magdeburg-Buckau, Germany. Eng. Pat. 10,418, July 17, 1915. Under Int. Conv., July 18, 1914.

THE ore-outlet end of a rotary furnace is constricted, and the narrow part made of such a length that the heating gases, which are led in centrally at a sufficiently high velocity at this end, pass through the sintering zone in a gradually expanding current without impinging directly on the furnace walls, and when, finally, they strike the latter, their temperature is so far reduced that there is no danger of a deposit being formed.—T. St.

Roasting and sintering ores; Apparatus for [continuously] —. J. Gayley, Assignor to American Ore Reclamation Co., New York. U.S. Pat. 1,107,109, Sept. 5, 1916. Date of appl., May 6, 1916.

THE material is fed from a hopper on to a set of grate bars moving continuously over the open top of the heating chamber. The grate bars are supported on pallets which are carried by wheels running on track bars. The joint between the pallets and the top of the chamber is maintained air-tight by flat plates or curtains resting on the sides of the chamber and sliding in vertical grooves in the pallets.—W. E. F. F.

Nickel ores; Process for desulphurising, reducing, and refining —. L. P. Burrows, Ottawa, Canada. Eng. Pat. 12,358, Aug. 27, 1915.

THE powdered (40-mesh) ore, e.g., Sudbury ore—contained in a revolving drum or digester, supported on hollow trunnions and enclosed in a furnace casing—is subjected to the action of the gases produced by heating suddenly-expanded dry steam to a high temperature; atmospheric oxygen is excluded from the drum during operation. Substances yielding chlorine or nitrogen by reaction with the ore under the conditions of treatment may be added to the latter as "fluxes." The volatile products of the reaction are recovered in a series of closed precipitation chambers, the non-volatile residue of reduced and refined nickel ore being removed periodically from the digester.—W. E. F. F.

Tungsten; Production of — from scheelite. J. C. Butterfield, London, and A. Ashworth, Bury. Eng. Pat. 16,562, Nov. 23, 1915.

SCHERLITE (calcium tungstate) is finely ground, briquetted with 12 to 13% of charcoal, and heated in a graphite crucible to 1100° or 1200° C. for 4 or 5 hours. The cold mass is crushed to pass through a 30- or 40-mesh sieve, and then fed on to a shaking or percussive dressing table, whereby the metallic tungsten is separated. The tungsten powder thus obtained may be washed with dilute hydrochloric acid to remove any remaining lime, when, after being washed free from acid, it is ready for the steel maker.—T. St.

Tungsten powder; Producing—[electrolytically]. F. G. Keyes and R. B. Brownlee, Assignors to Cooper Hewitt Electric Co., Hoboken, N.J. U.S. Pat. 1,196,699, Aug. 29, 1916. Date of appl., Feb. 17, 1915.

FUSED sodium tungstate is contained in a crucible, and a porous cup is partly immersed in the fused material, so that the material enters the cup to substantially the level of the material in the crucible. An anode and cathode dip respectively into the fused material in the crucible and cup. —B. N.

Quicksilver [mercury]; Apparatus for recovering—from its ore. W. H. Landers, New Almaden, Cal., Assignor to Pacific Foundry Co., San Francisco, Cal. U.S. Pat. 1,195,236, Aug. 22, 1916. Date of appl., Mar. 29, 1916.

THE apparatus comprises a roasting furnace, an outlet pipe from the furnace extending downwards into a dust-settling chamber, a pipe leading from the upper part of the latter to a condenser, and a pipe leading from the condenser to a stack. The cooling medium, after circulating around the condenser, is led to the stack to increase the draught through the apparatus. The temperature in the dust-settling chamber is kept sufficiently high to prevent condensation of mercury therein.—A. S.

Metals; Process for lead-plating—. J. C. McClintock and R. J. Shoemaker, Topeka, Kans. U.S. Pat. 1,195,376, Aug. 22, 1916. Date of appl., June 26, 1915.

AFTER treatment with hydrochloric acid to remove superficial oxides, the metal (still retaining a film of acid) is immersed in molten zinc chloride until it has attained the temperature of the latter, and then in molten lead. The bath of zinc chloride is supported on the bath of lead, both being maintained at 640°–680° F. (338°–360° C.), and the plated metal is withdrawn from the lead bath without further contact with the zinc chloride. —W. E. F. P.

Acid and insoluble metallic compounds; Method of making—. [Precipitation of copper.] G. D. Van Arsdale, New York. U.S. Pat. 1,195,421, Aug. 22, 1916. Date of appl., June 25, 1914.

COPPER is precipitated from a chloride solution, and free acid simultaneously produced, by treating the solution with sulphur dioxide and then bringing it in contact with metallic iron.—A. S.

Metals [copper]; Method of extracting—from their ores. *Process of making a leaching solution for extraction of metals from their ores.* H. B. Slater, Los Angeles, Cal. U.S. Pats. (A) 1,195,616 and (B) 1,195,617, Aug. 22, 1916. Dates of appl., Sept. 2, 1913, and July 28, 1915.

(A) THE ore is leached with a solution containing sodium chloride, ferric chloride, and hypochlorous acid, and the solution treated with sodium hydroxide to precipitate excess of iron. Copper is then recovered from the filtrate by precipitation, after which the ferric hydroxide previously removed is returned to the liquid and the mixture treated with free chlorine to regenerate the original solvent. (B) The solvent is prepared (or regenerated) by simultaneously electrolyzing a solution of ferrous and sodium chlorides in the anode compartment, and a solution of sodium chloride in the cathode compartment of an electrolytic cell. The compartments are separated by a diaphragm sufficiently permeable to allow the cathode products to diffuse into the anode compartment, the electrolysis being continued until all the ferrous chloride is oxidized and sufficient chlorine liberated to produce free hypochlorous acid in the liquid. —W. E. F. P.

[Roasting] furnace. Metallurgical furnace. U. Wedge, Ardmore, Pa., Assignor to The Furnace Patent Co., Philadelphia, Pa. U.S. Pats. (A) 1,195,424 and (B) 1,195,425, Aug. 22, 1916. Dates of appl., Jan. 20, 1910, and June 24, 1911. Both renewed Jan. 20, 1916.

(A) IN a multiple-hearth roasting furnace, some of the chambers are arranged for direct heating and others for muffle heating. A regulated supply of a reagent is delivered from a mechanical conveyor to the material in the muffle chambers. The material passes from the direct-heated chambers to the muffle chambers through passages sealed against the flow of gas, and air is supplied to and gases withdrawn from each chamber independently. The air supplied to the chambers in which the material is treated with a reagent is preheated in a chamber formed in one of the hearths in the upper portion of the furnace. (B) In a multiple-hearth furnace in which the material passes downwards from one hearth to the next, heating chambers are arranged in combination with the upper series of hearths so as to muffle the treating chambers above these hearths. Products of combustion from an outside source are supplied to the heating chambers and thence pass first into heating chambers below the hearths and then directly into the treating chambers above the lower series of hearths.—A. S.

[Metallurgical] heating furnace; Coal-burning—. E. C. Walker and A. S. Moses, Assignors to G. M. Ilges, St. Louis, Mo. U.S. Pat. 1,196,726, Aug. 29, 1916. Date of appl., June 11, 1913.

THE fuel is burnt in a vertical shaft tapering at the bottom and is supported by a ram extending across the bottom of the shaft. The ram is movable vertically and horizontally to stoke and purge the fuel bed.—A. S.

Metal from ores; [Electrically] scouring—. J. H. Reid, Newark, N.J. U.S. Pat. 1,195,607, Aug. 22, 1916. Date of appl., Jan. 13, 1914.

THE ore is supplied to an electric arc produced between depending iron electrodes. The alloy of iron with the metal of the ore thus produced, is treated with a metal of relatively low melting point, immiscible with iron and having a greater affinity for the metal of the ore, and the latter is subsequently recovered from the metal vehicle or carrier.—B. N.

Carnotite sandstone; Process of concentrating—. H. N. McCoy, Chicago, Ill. U.S. Pat. 1,195,698, Aug. 22, 1916. Date of appl., Feb. 12, 1916.

THE incrustation of carnotite is removed from the sand grains by a process of attrition in water, the radium-bearing slimes thus liberated being either separated as such or subjected to acid treatment for the recovery of radium.—W. E. F. P.

Soldering cast-iron, mild steel, aluminium, and the like; Composition of matter for—. W. A. Day, Bellingham, Wash. U.S. Pat. 1,195,955, Aug. 22, 1916. Date of appl., Mar. 8, 1916.

AN alloy composed of lead 1, tin 1, and zinc 2 parts by weight.—W. E. F. P.

Soldering metals; Method of—. L. M. Klauber, Wilkesburg, Pa., Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pat. 1,196,118, Aug. 29, 1916. Date of appl., Apr. 1, 1910.

AN acidified solution of a mercuric salt is applied to the surface or surfaces to be soldered, in order to deposit mercury thereon, and the amalgamated metal is immersed in molten solder heated to a temperature sufficiently high to expel the mercury. —A. S.

Centrifugal apparatus; High-temperature — [for separating metals, alloys, or speisses from their accompanying slags]. W. B. Wescott, Assignor to Kalmus, Constock, and Wescott, Inc., Boston, Mass. U.S. Pat. 1,196,829, Sept. 5, 1916. Date of appl., Mar. 19, 1914.

THE apparatus comprises a crucible rotating on a vertical axis and lined internally with refractory material. An inlet pipe at the top is cooled externally by a jacket and lined internally with electrically non-conducting refractory material having a heating coil embedded in it. The pipe has a removable delivery spout which delivers the material to be treated towards the top of the walls of the crucible. The crucible is provided with an outlet at the bottom.—W. F. F.

Metals; Method of reducing — [by electrolysis]. J. McNitt, Perth Amboy, N.J., Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,197,137, Sept. 5, 1916. Date of appl., Jan. 2, 1913.

THE electrolyte is fused in a furnace under pressure of an inert gas, and the pressure is further increased by the gas generated by the electrolytic action. The boiling point of the metal is thus raised, and the temperature is kept below the boiling point of the electrolyte at atmospheric pressure.—W. F. F.

Coating wire and the like; Means for — I. Hall, Birmingham. Eng. Pats. 13,224, Sept. 16, and 14,870, Oct. 20, 1915, and 101,470, Sept. 16, 1915 (Appl. No. 10,822 of 1916).

Separating oiled concentrates from the gangue of ores; Apparatus for — R. T. Mishler, Pomona, Cal. U.S. Pat. 1,197,843, Sept. 12, 1916. Date of appl., Sept. 13, 1915.

Plating metals; Process of — W. E. Watkins, New York, Assignor to The Metals Plating Co. U.S. Pat. 1,197,693, Sept. 12, 1916. Date of appl., Aug. 21, 1913.

SEE Eng. Pat. 18,932 of 1914; this J., 1916, 53.

Zinc solutions; Treatment of — for the recovery of the metal therefrom. R. Lance, Paris. U.S. Pat. 1,198,241, Sept. 12, 1916. Date of appl., June 24, 1914.

SEE Fr. Pat. 463,614 of 1912; this J., 1914, 421.

Nickel ores; Desulphurisation, reduction, and refining of — L. P. Burrows. Fr. Pat. 479,606, Aug. 27, 1915.

SEE Eng. Pat. 12,353 of 1915; preceding.

XI.—ELECTRO-CHEMISTRY.

Gas mixtures; Separation of — under the influence of a direct current. F. Skaupy, Ber. Deut. physik. Ges., 1916, 18, 230—232. J. Chem. Soc., 1916, 110, ii., 469.

WHEN a fairly strong current is passed through a discharge tube containing neon mixed with about 10% of argon, the anode end of the tube shows the neon spectrum and the cathode end the argon spectrum. Mixtures of helium and argon behave similarly, and the separation of gases under the influence of a direct current appears to be a general phenomenon. If the mixture is supplied at the middle of the discharge tube and the gases in the neighbourhood of the electrodes are removed, it is possible to effect a separation of the inert gases. When mercury or other vapours are mixed with the inert gases and subjected to the discharge, the active gases always move to the cathode. The observed behaviour is apparently determined by the magnitude of the ionisation

potential. A low value of the ionisation potential results in the production of large quantities of positive ions, whilst such ions may not be found at all when the ionisation potential has a larger value. The positive ions move to the cathode, and under the influence of the difference of gas pressure the unchanged molecules are constrained to move in the opposite direction. In consequence of the above described effects, it follows that gases or vapours (for example, salt vapour) introduced into a discharge tube containing inert gases through which a direct current is passing will only produce a satisfactory emissive effect if they are introduced at the anode.

Flame electrolytes; Validity of Faraday's law for — Faraday's law and the electrolytic separation of copper from flames. B. Thieme, Ber. Deut. physikal. Ges., 1916, 18, 187—194, 221—229. J. Chem. Soc., 1916, 110, ii., 460.

THE quantity of carbon deposited by the passage of a current through a hydrocarbon flame has been measured. The best results are obtained when the air supply is only just sufficient to prevent the separation of soot. The quantity of electrolytically deposited carbon is in fair agreement with the requirements of Faraday's law if the carbon atoms are supposed to carry a single unit of charge. From similar experiments made with a flame sprayed with a solution of copper sulphate, it is found that copper is deposited by an electric current passed through the flame in quantities consonant with Faraday's law.

PATENTS.

Primary galvanic battery cells with zinc anodes and alkaline electrolyte; Method for producing — J. N. Brönsted, and Hellesens Enke and V. Ludvigsen, Copenhagen. Eng. Pat. 16,471, Nov. 22, 1915.

AN alkali zincate is added to the electrolyte in the proportion of 2 to 8 equivalents of zincate to 100 equivalents of alkali, before finishing or finally closing the cell.—W. F. F.

Galvanic cell. A. Heil, Frankfurt, Germany. Assignor to C. Hubert and S. Stern, New York. U.S. Pat. 1,195,877, Aug. 22, 1916. Date of appl., Dec. 24, 1913.

THE cell is composed of positive and negative elements and a depolarising mass composed of an intimate mixture of a deep black hydrate of manganese dioxide, mercuric oxide, and carbon, together with an alkaline electrolyte.—B. N.

Furnaces; Apparatus for preventing sintering in electric — E. S. Berglund, Trollhättan, Sweden. U.S. Pat. 1,196,202, Aug. 29, 1916. Date of appl., Apr. 21, 1915.

THE charge is fed by gravitation through a feed shaft having a smaller cross-sectional area than that of the furnace chamber, and an auxiliary charge is fed mechanically into the chamber, at a point immediately below the opening of the feed shaft. Motion is thereby imparted to the charge in the chamber, in addition to the natural descending motion through the feed shaft.—B. N.

Furnace; Electrical — A. Eimer, New York. U.S. Pat. 1,197,275, Sept. 5, 1916. Date of appl., July 18, 1914.

A MUFFLE furnace is provided with interchangeable electrical heating members, which are reversible in order that either surface may be presented to the furnace interior, and the members are provided with interlocking edges for their engagement in either position. Each member is provided with a series of parallel exposed grooves on one side to contain a resistance conductor, with

inset notches alternating at opposite ends between adjacent grooves to carry the conductor from one groove to another, and the opposite side is provided with a smooth "conductor covering heating surface."—B. N.

Insulating compound; Chlorinated — J. W. Aylsworth, East Orange, N.J., Assignor to Halogen Products Co., Glen Ridge, N.J. U.S. Pat. 1,196,505, Aug. 29, 1916. Date of appl., Nov. 4, 1913.

A SMALL proportion of a basic oxide is added to a mixture of solid chloronaphthalenes, the chlorine content of which is at least equal to that of trichloronaphthalene, in order to break up unstable addition products, and the resultant product is distilled in the presence of the basic oxide. Hydrochloric acid is eliminated from the composition, and the unstable products, from which hydrochloric acid might be evolved by subsequent heating of the composition to its boiling point, are also decomposed and eliminated.—B. N.

Electric furnaces. J. L. Dixon, Detroit, Mich. U.S. Pats. 1,197,458 and 1,197,459, Sept. 5, 1916. Date of appl., Apr. 10, 1916.

SEE Eng. Pats. 4742, 8513, 16,263, and 17,909 of 1914; this J., 1915, 233.

Electrolytic process for the extraction of cobalt oxides. U.S. Pat. 1,105,211. See VII.

Manufacture of hydrogen peroxide. U.S. Pat. 1,195,500. See VII.

Process of extracting alkali-metal compounds. U.S. Pat. 1,197,556. See VII.

XII.—FATS; OILS; WAXES.

Vegetable oils; New sources of — Z. angew. Chem., 1916, 29, 337–338.

Asparagus seeds yielded, on extraction, 12% of oil. They should also be suitable for fodder. *Cherry-stone oil*:—Large quantities of the waste stones are obtainable from the manufacturers of cherry liqueurs in S. Germany. *Lime tree fruit* contained 9.4% of oil, while *elm-tree fruit* yielded 9 to 14% of oil. The oils from these and other seeds had the following characters:—

	Asparagus seed oil.	Lime tree oil.	Maple fruit, <i>Acer pseudo-platanus</i> .	Maple fruit, <i>Acer platanoides</i> .	Pear pip oil.	Apple pip oil.	Canary seed oil, <i>Phalaris canariensis</i> .	Elm oil, <i>Ulmus campestris</i> .	Elm oil, <i>T. Campestris</i> 1916.
Acid value	6.5	12.2	13.8	22.5	2.3	2.9	20.8	31.5	8.3
Saponif. value	193.4	195.2	179.8	157.0	197.5	189.5	184	272	224.5
Iodine value	140	126.0	93	100	126.5	119.8	115.5	26.5	28.8
Unsaponifiable %	0.96	1.5	6.95	8.72	0.5	1.2	1.5	10.8	8.7
Neutralisation value of fatty acids	200	198.5	—	183.0	203	195.5	203	273.5	264
M.pt. of fatty acids	fluid	fluid	about 25° C.	fluid	fluid	fluid	about 25° C.	37° C.	fluid
Iodine value of fatty acids	142.2	128.0	—	99.2	128.9	129.5	126.3	25.1	31.4
Refraction at 25° C.	73.75	71.3	62.4 at 40° C.	71 at 40° C.	70.65	70.55	68.7	39.2 at 40° C.	39.7

—C. A. M.

Japanese seal oil. M. Tsujimoto. Kōgyō-Kwagaku Zasshi, 1916, 19, 715–722.

A SAMPLE of seal oil from Sakhalin remained clear at 0° C., but solidified to a viscous mass at –10° C. When heated in a thin layer for 1½ hours at 100° C. it became very viscous. It could be readily refined by means of Kambara earth. It had the following characters:—Sp.gr. at 15°/4° C., 0.9264; acid value, 3.18; saponif. value, 190.61; iodine value (Wijs), 154.58; n_D²⁰=1.4795; unsaponif. matter, 0.38%; oxidised acids, 0.37%; m.pt. of fatty acids, mostly liquid at 23° C.; insoluble

bromides of fatty acids (70.16% Br), 38.34%. The oil is thus very similar to European seal oil and Japanese northern fur seal oil. The liquid fatty acids were hydrogenated in the presence of platinum black, and the resulting solid fatty acids were fractionally precipitated with magnesium acetate. Fractions melting at about 55° C. and having neutralisation values of 208 to 214 were obtained. Apparently these were mixtures of palmitic and stearic acids. Another portion of the liquid fatty acids was esterified, and the methyl esters were fractionally distilled under a pressure of 15 mm. The first fraction had saponif. value, 204.42 and iodine value 107.63. From these results the conclusion is drawn that the fatty acids of Japanese seal oil contain about 15% of an unsaturated acid lower in the series than oleic acid. This may be phytostolic acid or palmitoleic acid. The solid fatty acids consisted, in the main, of palmitic acid.—C. A. M.

Liver oils of sun-fish and Chimera phantasma. M. Tsujimoto. Kōgyō-Kwagaku Zasshi, 1916, 19, 723–727.

Sun-fish liver oil:—A sample of the liver of the sun-fish or "head-fish," *Mola mola* L., yielded 362 grms. per kilo. of an orange-red oil, with a peculiar fishy odour and a very unpleasant taste. It deposited a large quantity of "stearine" at the ordinary temperature. When refined with Kambara earth it became light yellowish-brown and coloured the earth dark green. It had the following characters: Sp.gr. at 15°/4° C., 0.9252; acid value, 8.19; saponif. value, 180.17; iodine value (Wijs), 151.77; n_D²⁰=1.4788; unsaponif. matter, 3.20%; m.pt. of fatty acids, 32° C.; insoluble bromides of fatty acids (69.1% Br), 43.18%. The unsaponifiable matter contained cholesterol and probably higher alcohols. No hydrocarbons such as are present in shark-liver oils (this J., 1916, 609) were found. *Liver oil of Chimera phantasma*:—Oil is sometimes prepared as a commercial product from the liver of this fish, which is known as the "rat-fish." A liver weighing 380 grms. yielded 220 grms. of an orange-yellow oil, which deposited a considerable amount of "stearine." It had a peculiar odour and unpleasant taste, and gave the following results:—Sp.gr. at 15°/4° C., 0.9161; acid value, 0.4; saponif. value, 172.79; iodine value (Wijs) 113.02; n_D²⁰=1.4728; unsaponif. matter, 8.52%; m.pt. of fatty acids, 30°–31° C.; neutralisation

value, 193.88; bromides of fatty acids (69.27% Br), 22.40%. The oil resembled certain shark-liver oils. The unsaponifiable matter was a yellow liquid containing cholesterol but no hydrocarbons.—C. A. M.

Glycerol in fatty oils; Determination of — by means of sodium glycerate. H. Bull. Chem.-Zeit., 1916, 40, 690.

FREE fatty acids are first removed as soap by diluting 10 grms. of the oil with light petroleum spirit to 100 c.c. in a cylinder, adding 10 c.c. of a

solution made by mixing 20 c.c. of 50% caustic potash solution with 240 c.c. of glycerin and 240 c.c. of water, mixing the solutions by inverting the cylinder several times, and allowing to stand overnight. The resulting soap solution thereby separates completely, leaving a clear supernatant liquid which is free from water. Thirty c.c. of the upper layer is transferred by means of a pipette to a 50 c.c. tube (2 cm. in width), 2 or 3 c.c. of 2-N sodium ethoxide (prepared by dissolving 23 grms. of sodium in absolute alcohol and diluting with alcohol to 500 c.c.) is added, the mixture made up to the 50 c.c. mark with light petroleum spirit, and the whole mixed and allowed to stand for some hours, so that the precipitated monosodium glycerate may settle. The excess of alkali in 25 c.c. of the clear solution is then titrated with *N*/10 hydrochloric acid, in presence of phenolphthalein and at least as much neutral alcohol as *N*/10 acid used, whilst the residue in the tube is mixed, transferred to a flask, the tube rinsed twice with 10 c.c. of alcohol, and the whole titrated at once with acid, preferably adding 5 c.c. of *N*/2 hydrochloric acid and then finishing with *N*/10 acid as before. The difference between the volumes of acid (reckoned as *N*/10) used in the two titrations, multiplied by the factor 0.0092, gives the weight of glycerol in 3 grms. of oil. The end-point of the titration is sharp, and the method is said to be both simple and accurate.—F. SOBN.

Fats; Hydrogenation of—in presence of metallic nickel and nickel oxides. W. Normann. Chem. Zeit., 1916, 40, 757—759.

ERDMANN (this J., 1915, 969) found that hydrogenation of fats was effected more rapidly in presence of unreduced nickel oxide than in that of the nickel previously reduced therefrom, whereas the author's experiments gave different results, nickel oxide acting catalytically only after its reduction to metallic form (this J., 1915, 237). Comparative experiments with different oxides of nickel and the powdered metal reduced from them have shown that the activity of the various catalysts varies with the physical form of the powders. In the case of some of them it was not possible to effect serviceable hydrogenation of the oil. In all cases, however, the action of the metal catalysts was superior to that of the oxides. Certain impurities in commercial oxides appear to have a very unfavourable effect upon the hydrogenation, whereas the same impurities have little or no effect upon the metal catalysts previously reduced from the oxides. A slight addition of hydrochloric acid had no effect on the oxide catalyst but had a stimulating effect on a metal catalyst; further additions had an injurious action on the oxide catalyst, and reduced the activity of the metal catalyst to its original degree. Sodium chloride behaved in an analogous manner. Sulphuric acid in small quantities promoted the activity of both oxide and metal catalysts; in larger proportion it had little effect upon the metal, but destroyed the increased activity of the oxide. The hydrogenation of oils may be effected as a technical process by means of metallic nickel without any carrier.—C. A. M.

Phytosterol; Marcussen-Schilling's modification of Bömer's method for the detection of—by precipitation with digitonin. A. Olig. Z. Unters. Nahr. Genussm., 1914, 28, 129—138. J. Chem. Soc., 1916, 110, ii, 499. (Compare this J., 1913, 1118.)

RESULTS of analyses of numerous mixtures of animal and vegetable fats showed that the melting point of the acetate, after the first or second crystallisation, almost always indicated whether phytosteryl acetate was present with the cholesterol acetate. The presence of paraffin and of certain waxy or resinous constituents of shea and

mowrah fats did not interfere with the test. In most cases it is sufficient to precipitate the cholesterol and phytosterol with digitonin directly from the fat; previous saponification of the fat and precipitation with digitonin from the fatty acids is necessary only when direct precipitation from the fat yields an inconclusive result, but this seldom occurs in practice.

Phytosterol in vegetable fats; Determination of—M. Klostermann and H. Opitz. Z. Unters. Nahr. Genussm., 1914, 28, 138—145. J. Chem. Soc., 1916, 110, ii, 499.

THE quantity of phytosterol in vegetable oils varies from 0.133% in the case of olive oil to 0.549% in sesame oil; in many of the vegetable oils a large proportion of the phytosterol is present in the form of its ester. In the detection of vegetable oils in animal fats it is therefore advisable to saponify the fat before the phytosterol and cholesterol are precipitated with digitonin, since the latter precipitates the free alcohols only. It is pointed out that the quantity of phytosterol in a vegetable oil depends on the method by which the oil has been obtained from the seeds, etc.

Detection of tallow and hydrogenated fats in butter fat. Amberger. See XIXa.

Hydnocarpus venenata, Gaertner; false chamomogra. Brill. See XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Colophony and abietic acid. G. Cohn. Chem. Zeit., 1916, 40, 791—792.

COLOPHONY when treated with strong ammonia is converted into a brown gelatinous mass, which dries to a solid resin readily soluble in water. The solution behaves in exactly the same way as that of the ammonium salts of artificial resin acids (this J., 1916, 1025). It precipitates basic dyestuffs on the addition of acetic acid, and gives precipitates with alkaloids (morphine, etc.). The pale green copper salt is readily soluble in ether, whilst it is practically insoluble in methyl alcohol and in an excess of ammonia solution. By treatment with ether it may be separated from another salt which is present in a proportion varying with the origin and age of the colophony, and which when decomposed with hydrochloric acid yields an amorphous resin acid. On evaporating the ethereal solution copper abietate is left. This is not decomposed by hydrochloric acid, even on heating for a short time, but is readily decomposed by the acid when ether is also present. Bases such as ammonia, piperidine, etc., act upon colophony in the presence of water, producing a gel, the consistency of which depends upon the proportion of base. An excess of base liquefies the gel. Pure abietic acid may be rapidly prepared by gently heating 50 parts of white colophony with a mixture of 50 parts of pure methyl alcohol and 6 to 7 parts of strong sulphuric acid on the water-bath, with frequent shaking and stirring, until a crystalline mass is obtained. This is cooled, drained, triturated with cold methyl alcohol, and again separated. The resulting abietic acid melts at 156° to 162° C. and may be further purified by recrystallisation from methyl alcohol. It behaves towards ammonia like colophony. On adding ammonia to its solution in oil of turpentine the ammonium salt crystallises, whilst the oil is gradually gelatinised. It gives precipitates with basic dyestuffs in the same way as the artificial resin acids. A sample of the pure acid heated at 160° to 170° C. left, on cooling, a fused mass, which showed no tendency to recrystallisation. Its sp.gr. was 1.072 (that of the original

white colophony being 1.08), and it behaved towards ammonia, methyl alcohol, and strong sulphuric acid in the same way as natural colophony. By heating the fused abietic acid to about 200° C. a yellow colophony (sp.gr. 1.07) was obtained. There was no loss in weight during either heating, so that no anhydride formation could have occurred. These results indicate that natural colophony must be regarded as a more or less impure vitreous modification of abietic acid.

—C. A. M.

Rosin; The Liebermann-Storch colour test for —. P. E. Jameson. J. Ind. Eng. Chem., 1916, 8, 855.

KAURI resin, like colophony, gives a deep violet-red colour changing to brown with the Liebermann-Storch reagent; the colour is most intense with varieties having a milky core surrounded by a nearly transparent shell, whilst in the varieties known as "Swamp" or "Brown Kauri," the colour is, to a great extent, masked by impurities. Following are the reactions given by some of the chief varnish resins with the Liebermann-Storch reagent:—amber and East India and black dammar resins, deep wine red changing to brown; Manila, pontianac, and Borneo resins, dark-brown; Batavia and Singapore dammar resins (recent), deep wine red colour which does not change on standing. Some specimens of Manila resin give a reaction similar to that of rosin. Contrary to the usual statements in text-books, cholesterol does not give a violet colour, but a deep blue colour, quickly changing to green.—A. S.

PATENTS.

Phenols and formaldehyde; Condensation product of— and process of making same. J. W. Aylsworth, East Orange, N.J., Assignor to Condensite Company of America, Bloomfield, N.J. U.S. Pat. 1,197,171, Sept. 5, 1916. Date of appl. June 16, 1915.

PHENOL is caused to interact with a compound containing a reactive methylene group, in proportions suitable to form an infusible product, under the influence of sulphuric or other mineral acid, and when the reaction is partially complete, a substance, such as barium carbonate, is added, which is capable of forming an insoluble, electrically insulating salt with the mineral acid, the quantity used being at least sufficient to combine with the whole of the acid present in the mass.

—J. F. B.

Phenols and formaldehyde; Condensation product of— T. S. Wennagel, Hamburg, Assignor to Naamloze Vennootschap Hollandsche Proteïne Maatschappij, Amsterdam. U.S. Pat. 1,197,316, Sept. 5, 1916. Date of appl. July 30, 1915.

A MIXTURE of phenol, aldehydes, and fatty or oily triglycerides, with or without a quantity of resin preferably equal to the fatty or oily substances, is treated with double the amount of alkali required for the saponification of the triglycerides and of the resin, if present; the water is distilled off, and the mass cast into moulds.—J. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

PATENTS.

Vulcanised rubber waste; Process for the partial separation of the combined sulphur in— W. Esch, Hamburg. Ger. Pat. 293,496, Nov. 7, 1912.

THE scrap rubber is treated with alkali to remove free sulphur, then dissolved in a phenolic solvent and the solution emulsified with the aid of an alkali. The emulsion is filtered, if necessary, and

heated with a metal (zinc or aluminium) capable of liberating hydrogen from alkalis; part of the sulphur combined with the rubber is thus converted into hydrogen sulphide and the rubber is depolymerised. The emulsion is then treated with carbon dioxide, allowed to settle, and the supernatant solution of depolymerised rubber removed. The solvent is distilled off with steam under diminished pressure, and the residue is dried, mixed with a polymerising agent, e.g., about 5% of sodium, heated for about two days at 80° C., washed, and dried.—A. S.

Process of treating textile materials [with rubber] and the article produced thereby. Eng. Pat. 101,318. See V.

XV.—LEATHER; BONE; HORN; GLUE.

Skin; Biochemical studies of— G. J. Rosenthal. J. Amer. Leather Chem. Assoc., 1916, 11, 463—495.

AN account of the chemistry of skin is followed by a description of experiments made on dogskin, calfskin, and kid and cabretta skins, in order to ascertain what chemical changes take place during the usual processes preliminary to tanning. A dogskin was cut into pieces corresponding to butt, shoulder, and bellies, and the pieces dried *in vacuo* for eight hours at 55°–60° C. The skin was then ground to powder. Small samples were treated with 10% brine at 37° C. until no further amount of coagulable protein could be obtained. The residue was washed, and extracted under toluol with half-saturated lime water to remove mucins. Elastin was removed by subsequent alkaline tryptic digestion, and the residue from this treatment was digested in a 0.2% hydrochloric acid solution of pepsin to remove collagen. The final residue was taken as keratin. This process was carried out with fresh dogskin, and in the case of calfskin with (1) fresh skin, (2) skin after 42 hours' soaking, (3) and (4) skin after 24 and 68 hours' liming, (5) after 120 hours' liming, then unhairing and washing, and (6) after bating. The composition of both dogskin and calfskin was found to vary considerably in different portions of the skin. During the soaking to bating processes it was found that the content in coagulable protein steadily rises, elastin disappears during bating after a gradual decrease during liming, and both mucin and keratin are lost during liming. It is noticeable that there is much more mucin in the butt of calfskin than in the shoulder or belly. Other experiments showed that the ash content of the skin rose to a maximum at stage (1) and then decreased almost to its original value. The experiments on kid and cabretta skins gave very similar results. Sections of skin were cut at the above-mentioned stages and showed very distinct changes. In the case of calfskin the outer horny layer was affected by the soaking, the cell boundaries disappearing; during liming the entire epithelial layer is destroyed and the connective tissue loses its fibrillary structure; after bating, the corium alone is left, with an occasional strand of connective tissue. Photographs of the sections are included in the paper, and a bibliography is appended.—F. C. T.

Leather; [Determination of] total sulphates in— L. E. Levi and A. C. Orthmann. J. Amer. Leather Chem. Assoc., 1916, 11, 496—498.

LEATHER from which fat has been extracted is oxidised with a mixture of chromic and hydrochloric acids, and sulphates are estimated in the solution. The method is accurate and rapid.

—F. C. T.

Leathers; Wear resistance of sole — L. Balderston. J. Amer. Leather Chem. Assoc., 1916, 11, 498—500.

FURTHER experiments were carried out as previously described (this J., 1916, 935), except that the amount of friction was reduced, and the speed increased. It was found that the grain side of leather offers more resistance than the flesh side.—F. C. T.

Chrome tanning liquors; Determination of the basicity of — W. Appelius and R. Schmidt. Ledertechn. Rundsch., 1916, 8, 85—86. Z. angew. Chem., 1916, 29, Ref., 339.

To determine the acid combined with chromium, the diluted solution is boiled with finely-divided cupric oxide, whereby the chromium is precipitated and a quantity of copper corresponding to the acid combined with chromium is dissolved; the dissolved copper is determined by the iodide method. The quantity of dissolved copper for 100 grms. Cr_2O_3 is termed the "copper value," and the authors have constructed a table from which the basicity corresponding to a given "copper value" may be read directly.—A. S.

PATENTS.

Hides; Process for removing hair from — G. Maag. New York. U.S. Pat. 1,197,519, Sept. 5, 1916. Date of appl., Aug. 26, 1912; renewed Nov. 6, 1915.

The hides are agitated at 95° F. (35° C.) with a solution containing 10% of their weight of sodium sulphide at a density of about 1.5° B. (sp.gr. 1.004).—J. F. B.

Condensation products [tanning agents] from α - or β -naphthylaminemono- or disulphonic acids or mixtures of these acids, and formaldehyde; Preparation of — Deutsch-Koloniale Gerb- und Farbstoff-Ges. m. b. H., Karlsruhe. Ger. Pat. 293,041, June 20, 1913.

SOLUBLE tanning agents are obtained by condensing formaldehyde with α - or β -naphthylaminemono- or disulphonic acids or their salts, or mixtures of these acids or salts, in presence of a quantity of concentrated sulphuric acid equal to from three to five times the quantity of the naphthylamine derivative. The products, unlike those described in Eng. Pat. 4648 of 1911 (this J., 1912, 325), do not contain sulphur.—A. S.

Condensation products [tanning agents] from α - or β -naphthol or their sulphonic acids; Preparation of — Deutsch-Koloniale Gerb- und Farbstoff-Ges. m. b. H., Karlsruhe. Ger. Pats. (A) 293,042, June 22, 1913, and (B) 293,093, Oct. 1, 1913.

(A) SOLUBLE products which precipitate gelatin from neutral solutions and even from solutions containing sodium carbonate, are obtained by heating α - or β -naphthol mixed with the calculated quantity or a slight excess of concentrated sulphuric acid, or α - or β -naphtholsulphonic acids or their salts, alone or mixed with a small quantity of concentrated sulphuric acid, for a long time above 100° C., or by treating naphtholsulphonic acids with phosphorus oxychloride or analogous condensing agents at lower temperatures (up to 100° C.), in some cases with addition of small quantities of concentrated sulphuric acid, and with exclusion of air or in a vacuum. (B) Products less soluble than those described above, but very effective as gelatin precipitants, are obtained by heating naphtholsulphonic acids with excess of phosphorus oxychloride at a high temperature.—A. S.

Method of waterproofing the soles of footwear. Eng. Pat. 12,839. See V.

XVI.—SOILS; FERTILISERS.

Soil; Influence of barnyard [farmyard] manure and water upon the bacterial activities of the — J. E. Greaves and E. G. Carter. J. Agric. Res., 1916, 6, 889—926.

THE effects of measured quantities of farmyard manure and of irrigation water upon the bacterial activities of a light calcareous soil (Greenville Experiment Farm, Utah) were determined when the soil was potted and kept fallow, when fallowed under field conditions, and when it was under corn (maize) in the open. The bacterial numbers were estimated by counting the colonies which developed on a modified agar medium, the ammonifying power was determined by mixing 2 grms. of dried blood with 100-grm. portions of the soil, incubating for 4 days, adding 250 c.c. of water, distilling off the ammonia with 2 grms. of magnesium oxide, and collecting it in N 10 sulphuric acid. The nitrifying power was found in a similar way except that the incubation period was 21 days, and, in addition to the water, 2 grms. of powdered lime was added and the whole shaken in a machine for 10 minutes, after which the nitrates in the clear liquid were determined by the aluminium reduction method. The nitrogen-fixing power was found by placing 5-grm. portions of the soil into 100 c.c. of Ashby's solution, incubating for 18 days, and then determining the total nitrogen by Kjeldahl's method. In the pot experiments, the manure was applied at the rates of 5, 10, 15, 20, and 25 tons per acre, and the moisture content was kept at 12.5, 15, 17.5, 20, and 22.5% by weight. The bacterial numbers were not greatly affected by the changing conditions, but from 10 tons of manure upwards they increased regularly. The optimum moisture content was 12.5%. The average temperatures of the manured and unmanured soils were practically the same, but soil containing 12.5% of moisture averaged 1° C. higher than soil with 22.5%. The ammonifying power was much influenced by changes in the manural and water contents; it increased regularly with the amount of dung applied and the greatest increase per ton of manure was observed in the soil receiving 5 tons. Ammonification was accelerated as the water applied increased up to 20%, and the greatest effect was noted when the water was increased from 12.5 to 15%. Increase of manure, even up to 25 tons, greatly increased the amount of nitrification, which attained a maximum with 17.5% of water. The greatest increase per unit of manure took place with the smallest application. Although the nitrogen-fixing power was but little affected, it increased regularly up to 10 tons of manure per acre, and then decreased; it also increased with the amount of irrigation water added. There was no evidence of denitrification. The plots (24.7 ft.) of fallow field soil were treated with 5 and 15 tons of manure per acre, and with 5, 10, 20, 30, and 40 inches of water at intervals between May and November, in addition to a rainfall of about 5 inches. The bacteria were at a maximum in the plot receiving 15 tons of manure, and their number increased up to 20 inches of added water, the gain being most marked in the soil containing the most manure. Taking the ammonifying power of the unmanured and unirrigated plots as 100%, 5 tons of manure gave 147%, and 15 tons of 188%; 10 inches of water 117%, 20 inches 168%, 30 inches 108%, and 40 inches 108%. The greatest depressing effect of large quantities of water was observed with 15 tons of manure. Nitrification was stimulated by increasing the manural dressing, but depressed by increasing the water supply. In the field experiments on cropped plots, the bacterial population behaved similarly to that on the fallow land, but the number

was always lower. Ammonifying power increased with the amount of manure and also with the water supply up to 30 inches; it was depressed in the soil receiving 40 inches of water, and particularly in presence of 15 tons of water, and nitrifying power was slightly less than in the fallow plots, but here again it appreciated with increasing manurial dressings; it also increased greatly with the amount of water added up to 30 inches, especially on the plots receiving 15 tons of manure. In general, the results showed that the crop-producing property of a soil is closely connected with its bacterial activities, particularly with its ammonifying and nitrifying powers.

—E. H. T.

Soil: Bacteriological studies of a — subjected to different systems of cropping for twenty-five years.
P. L. Gainey and W. M. Gibbs. *J. Agric. Res.*, 1916, 6, 953—975.

THE bacterial activities of the Putnam silt loam soil belonging to the Missouri Experiment Station formed the subject of investigation during 1913 and 1914. The cropping systems adopted on the 1/10 acre plots were: a 6-year rotation of corn (maize), oats, wheat, clover, timothy, timothy; continuous maize, continuous wheat, and continuous timothy. Some of the plots received stable manure at the rate of 7 tons per acre, and two plots (continuous wheat and rotation) were dressed with sodium nitrate, potassium chloride, and superphosphate. Analytical determinations were made of the moisture content of the soils, of the water-holding capacity, and of the ammonifying and nitrifying action on the nitrogen of sterile cotton-seed meal. The bacterial counts, which were made on Temple's agar, disclosed marked differences between the various plots. In the absence of manure or fertiliser, the order was, timothy (greatest number), rotation, maize, wheat, the last two being nearly equal; but in the presence of manure the order was nearly reversed, viz., maize, wheat, timothy, rotation, the two first responding in a marked degree. The different cropping systems had no appreciable effect on the ammonifying powers of the soil, and there was no correlation between the latter and the bacterial counts. The reverse held good with the nitrifying powers. Continuous maize and wheat produced a low oxidising power in the absence of manure or fertiliser, but this power was considerably increased when these amendments were present, particularly with the manure. The percentage increases in the nitrifying powers due to the application of organic manure in 1914 were: maize 217, wheat 150, timothy 47, and rotation 28; and the increases following the application of chemicals were: wheat 103, rotation 30. The increases were very much smaller when calcium carbonate was added to the test samples, and the lowest increases were observed when both carbonate and soil amendment were present together. The effect of the addition of calcium carbonate in largely eliminating the differences in nitrate formation within the soil itself, could not be correlated with its effect on the lime requirement.—E. H. T.

Sodium salts in the soil; Effect on plant growth of —.
F. B. Headley, E. W. Curtis, and C. S. Scofield. *J. Agric. Res.*, 1916, 6, 857—869.

IN connection with an attempt to reclaim a tract of salt land in Nevada, experiments were made to determine the limits of tolerance of wheat seedlings to the carbonate, bicarbonate, chloride, and sulphate of sodium. The plants were grown from seed in a fairly rich sandy loam soil contained in glass tumblers. It was found that only a fraction of the added salts could be recovered from the soil by digestion with water, and that the limit of tolerance was better determined by the amount of

salt thus recovered, and by the amount left in the soil solution, than by the quantity added. Sodium chloride was absorbed by the soil much less readily than either the carbonate or the sulphate, and the absorption of carbonate was greater in a rich loam soil than in a sandy soil. The carbonate and bicarbonate are mutually interchangeable in the soil, and the toxicity of these salts is conditioned solely by the amount of base that enters the soil solution. The quantity of recoverable salt which prevented germination was, for the carbonates, 0.13% of the dry weight of the soil; for the chloride, 0.52%; for the sulphate, 0.56%; and the amounts which reduced by one-half the growth of the seedlings were 0.04%, 0.16%, and 0.35% respectively.—E. H. T.

Superphosphates: Technological-chemical research on —.
U. Pratolongo. *Annali Chim. Appl.*, 1916, 6, 59—112.

MANY samples of superphosphate were examined by the author chemically and with the petrographic microscope, and experiments were made on the conditions of equilibrium of the system, lime, phosphoric acid, and water at 75°C. and at 100°C., and on the influence of various factors on the physical properties of superphosphate. Contrary to the view generally accepted, the calcium sulphate present in superphosphate prepared from mineral phosphates usually exists mainly or entirely as anhydrite; only in rare instances is it present chiefly or solely as the dihydrate. In bone superphosphate, on the other hand, usually prepared with a restricted quantity of sulphuric acid, the dihydrate is present more frequently. Mono- and di-calcium phosphates occur usually only in the hydrated form, but the anhydrous salts are also sometimes present. The physical properties of superphosphate depend chiefly on the amount of the liquid phase which is always present. For analytical purposes the liquid phase is defined as the sum of the free water and the free phosphoric acid. To determine these the superphosphate is extracted with cold 95% alcohol, and the residue is washed with a little ether, dried for 1 hour at 80°C., and weighed; the loss of weight corresponds to the free water plus free phosphoric acid. In the alcoholic solution, after dilution with water, the phosphoric acid is determined either volumetrically or gravimetrically. Results obtained with numerous commercial samples of superphosphate indicate that in general the best products in regard to dryness and friability are those in which the liquid phase is less than 15%; products containing 15—18% of liquid phase are still dry and friable, those containing 18—25% are slightly moist and cake when compressed, whilst those containing more than 25% of liquid phase are moist and readily cake. In the technical preparation of superphosphate the first stage consists in the reaction of sulphuric acid with part of the tricalcium phosphate to form calcium sulphate and phosphoric acid. In the second phase the free phosphoric acid reacts with a further quantity of the tricalcium phosphate; this reaction proceeds with appreciable velocity only above 50°—60°C., and with sufficient velocity for technical purposes only at 70°—80°C. As the temperature of reaction increases, the amounts of free water and of free phosphoric acid in the product also increase; hence attempts to improve the physical characters of superphosphate by increasing the temperature of reaction are irrational. The best results will be obtained when the reaction temperature is from 80°—100°C., and as the quantity and concentration of the sulphuric acid used in practice may be regarded as fixed, the aim should be to maintain the desired temperature by variation of other factors, such as the dissipation of heat during the process, the

total mass of the system, the duration of the mixing process, and the quantity of water evaporated, e.g., by ventilation of the superphosphate dens.—A. S.

Phosphates; Causes that influence the solubility in citric acid of sparingly soluble—. A. Aita. *Annali Chim. Appl.*, 1916, 6, 119—131.

EXPERIMENTS on lines similar to those described previously (this J., 1916, 974) showed that the solubility of the phosphoric acid of mineral phosphates in 2% citric acid is diminished in presence of sodium silicate or magnesium silicate, but increases in presence of ferrous sulphate or manganous sulphate in proportion to the concentration of the latter. In presence of ferric sulphate, ferric chloride, or aluminium sulphate, the solubility increases more rapidly than the concentration of the added salts. In explanation of this it is considered that in addition to the effect of the salts on the equilibrium between phosphoric acid and citric acid, to which the action of ferrous and manganous salts is due, ferric ions and aluminium ions form complex citrophosphates. In basic slag there are present secondary constituents which on the one hand diminish the citric acid solubility, e.g., lime, silicates, etc., and others, such as sulphates, aluminium, and iron, which increase the solubility. It is considered that the phosphoric acid of basic slag is present as tricalcium phosphate and that its relatively high solubility in citric acid is due principally to the effect of the aluminium and ferric ions present. From this it follows that the difference in price between the phosphoric acid of basic slag and of mineral phosphates is not justified and that the Wagner citric acid test cannot be considered satisfactory as it does not take into account the influence of secondary constituents on the solubility of the phosphoric acid. (See also Robertson, this J., 1914, 9; 1916, 217; Collins and Hall, this J., 1915, 526.)—A. S.

Basic slag; The citric solubility of—. J. Board. *Agric.*, 1916, 23, 540—549.

FROM 1911 to 1913, experiments were conducted at five German experimental stations in order to study the relation between soil fertility and the content of total phosphoric acid and of citric soluble phosphoric acid in basic slag. At Bremen, pot experiments on mustard and rye, grown in sandy and "low" moor soils, showed that the manurial value of the slag was different for different soils, but that the citric solubility test gave a very fair indication of it, provided that the fineness did not fall below certain limits. In the Bromberg experiments, mustard and oats followed by mustard were grown in a loam very deficient in phosphoric acid. It was found that the fertilising value of the slag depended not only upon the total P_2O_5 content but was intimately connected with the citric solubility. The results at Halle, where rye, oats, and mustard were grown in a soil of 90% sand and 10% loam, indicated that the crop yields were independent of the fineness and alkalinity of the slags, but were probably influenced by the citric solubility. The Harleshausen tests gave unfavourable results, probably owing to the nature of the soils used. At Möckern, barley and peas were grown in a quartz soil, with and without added lime or gypsum, and in a sand containing a little lime but no humus. The crops of total dry matter showed that the citric acid test was a better index of manurial value than the total P_2O_5 content. The manurial effects varied most with the cultivation and the experimental conditions, but to a lesser extent with the nature of the soil and the crop. The general conclusion reached was that there were no grounds for altering the usual methods of evaluating basic slags.—E. H. T.

Calcium cyanamide; Analysis of crude—. E. Truninger. *Schweiz. Ver. anal. Chem.*, May 26 and 27, 1916. *Chem.-Zeit.*, 1916, 40, 812—813. (See also this J., 1916, 647.)

A SLIGHT alteration is to be made in the method previously described: the cyanamide should be precipitated with neutral silver nitrate and the ammonia added afterwards. For the present, the dicyandiamide may be determined indirectly by the simultaneous precipitation of cyanamide and dicyandiamide with silver nitrate and 2% potassium hydroxide solution and subsequent determination of the nitrogen in the precipitate by Kjeldahl's method. The determination of urea has not been deeply studied because it is not yet certain whether that substance is present. Caro's method (this J., 1911, 23) could not give accurate results, because the prolonged heating with alkali to drive off the ammonia would cause losses not only of dicyandiamide but also of urea if present. Determinations of the insoluble nitrogen in the residue from the extraction of the crude material with water and dilute nitric acid showed an average of 1%; in a few cases 2% was found. Agricultural experiments with calcium cyanamide on oats confirmed its favourable effects; with the exception of a single sample rich in dicyandiamide, an increased yield was recorded. The injurious influence of considerable quantities of this substance was shown at an early stage but could be largely inhibited by the simultaneous application of a readily assimilable nitrogen compound. In considering the unfavourable influence of the dicyandiamide, its great stability in the soil must be taken into account; nitrification had not taken place after a period of two months. Secondary ill-effects were observed in the case of oats even in the second year; on the other hand calcium cyanamide which had lain for a long time on the moist ground had lost much of its valuable properties. Vegetation experiments with urea and urea nitrate showed excellent results with oats. With winter wheat a top dressing of calcium cyanamide and urea showed the great value of urea used in this form.—J. F. B.

"Marine kainit." U.S. Com. Rep., Sept. 23, 1916

A POTASH fertiliser, called "marine kainit," now containing about 12% of potash, is now being produced in Spain from the mother liquors from the manufacture of sea-salt. After a preliminary evaporation of the liquors to remove a part of the salts, the residual liquor is evaporated to dryness. The product is said to be superior in many respects to ordinary kainit, particularly on account of its hygroscopic properties.

PATENTS.

Fertiliser; An improved—. [from activated sewage sludge]. G. J. Fowler and G. Mumford. *Manchester. Eng. Pat.* 8397, June 7, 1915.

THE solid residue obtained from sludge from sewage purified by forcing air through it, is heated and dried at a temperature not exceeding 100° C. as a rule, and then rendered bacterially active by the addition of about 5—10% of its bulk of fresh activated sludge. Alternatively, the heating may be carried out at 60°—70° C. for from 12 to 48 hours, in which case the contained moulds, seeds, etc., are killed, but sufficient beneficial bacteria are left to revivify the fertiliser and cause it to become bacterially active in a short time. (See this J., 1916, 552, 647.)—E. H. T.

Fertilisers; Manufacture of—. D. Shields, Edgeworth, Pa. U.S. Pat. 1,196,889, Sept. 5, 1916. Date of appl., Mar. 11, 1916.

FINELY divided coal is mixed with "subterranean salt water," the mixture heated, the coal impregnated with salts, is incorporated with at least

an equal quantity of finely divided clay, and the product allowed to age.—F. SODN.

Fertiliser formed by the addition of ammonium sulphate and acid phosphate to calcium cyanamide, and process of making same. F. S. Washburn, Nashville, Tenn., Assignor to American Cyanamid Co. U.S. Pat. 1,196,910, Sept. 5, 1916. Date of appl., Nov. 17, 1914.

COMMERCIAL calcium cyanamide is mixed with ammonium sulphate and sufficient acid fertiliser material, e.g., acid phosphate, added to prevent the escape of ammonia.—F. SODN.

Feldspar, feldspathic rock and other potash-bearing silicate rocks; Process for treating— for use as a fertilizer, or for further treatment by weak acids for the recovery of potash and alumina. C. W. Drury, Kingston, Ontario. Eng. Pat. 15,432, Nov. 2, 1915. Under Int. Conv., Dec. 28, 1914.

SEE U.S. Pat. 1,150,815 of 1915; this J., 1915, 973.

Citrate-soluble phosphate; Manufacture of—. S. B. Newberry, Cleveland, Ohio, U.S.A. Eng. Pat. 16,558, Nov. 23, 1915.

SEE U.S. Pats. 1,162,802 and 1,162,944 of 1915; this J., 1916, 133. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 13,890, 13,891, 19,044, and 19,045 of 1911.)

XVII.—SUGARS; STARCHES; GUMS.

One sugar factory; Relative purity of raw and clarified juices and of syrups in the—. H. Pellet. Int. Sugar J., 1916, 18, 420—421.

URING evaporation of clarified juices there is no destruction of reducing sugars but rather a slight increase, especially during any stoppage or diminution in the rate of operating. The syrup rarely stains the purity of the clarified juice; for a satisfactory comparison it is necessary to take numerous and regular samples and bring the syrup to the same dilution as the juice before analysis.—J. H. L.

Sugars; Precipitation of reducing—by basic lead acetate. N. Deerr. Int. Sugar J., 1916, 18, 402—404.

STATEMENTS in a recent paper by Davis (this J., 1916, 203) led the author to make the experiments described, which show that when basic lead acetate is added to a solution of invert sugar containing sodium sulphate, a considerable proportion of the sugar, in some cases more than one-half, is carried down with the lead precipitate, and addition of an excess of sodium sulphate does not redissolve it. The sugar thus removed from solution can be quantitatively recovered by treating the precipitate with dilute sulphuric acid, the reducing powers of this acid extract and of the original filtrate from the lead precipitate being together equal to that of the invert sugar solution employed. Conversion of reducing sugars into glucose, as suggested by Davis, may possibly occur on prolonged exposure to basic lead acetate even at low temperatures, but in the author's experiments prolonged exposure was avoided.—J. H. L.

Pentoses; Total destruction of—during alcoholic fermentation. [Analysis of molasses.] H. Pellet. Comptes rend., 1916, 163, 274—276. (See also Cross and Tollens, this J., 1912, 198.)

In the fermentation of mixtures of arabinose or xylose with fermentable sugars, a considerable part or even the whole of the pentose may be decomposed in the course of a few days if only a small amount of yeast is present. When it is

desired to eliminate the other sugars completely in order to determine the pentose by copper-reduction, a relatively large amount of yeast should be used so that fermentation is completed before the pentose is appreciably attacked. The author found, for example, that if 1 litre of a solution containing 100 grms. of beet molasses and 1 or 2 grms. of arabinose, is fermented with 50 grms. of ordinary pressed yeast, fermentation is practically complete in 24 hours without any decomposition of pentose, but after 48 hours no pentose remains. In the case of cane molasses, which ferments more rapidly than beet molasses, some destruction of pentose occurs even within 24 hours, and it is advisable to stop the fermentation after 6 or 12 hours, while the liquid still contains a little unfermented sugar. The composition of the fermenting liquid, especially as regards fermentable sugars, seems to influence very considerably the rate of destruction of pentoses by yeast. Applying these observations to the analysis of molasses, the author found that beet molasses contains no appreciable quantity of pentoses, and cane molasses contains a reducing substance (probably the glucose of van Ekenstein) which, unlike pentoses, is not fermentable under any conditions.—J. H. L.

Action of X-rays on iodine and starch iodide in aqueous media. Bordier. See VII.

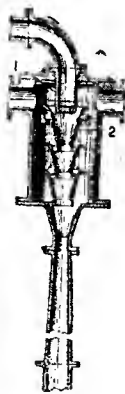
Colorimetric method for detection of potato starch Blunck. See XIXA.

Products of the action of certain amylases upon soluble starch, with special reference to the formation of dextrose. Sherman and Punnett. See XVIII.

Experiments upon starch as substrate for enzyme action. Sherman and Baker. See XVIII.

PATENTS.

Saccharine juices; Apparatus for the gaseous treatment of—. N. A. Lockwood, Ogden, Utah. U.S. Pat. 1,195,044, Aug. 15, 1916. Date of appl., Feb. 9, 1916.



THE juice enters a closed receptacle forming a gas chamber provided with an inlet for the treating gas and means for receiving and conveying the incoming liquid and gas, including a hollow truncated inverted cone, 2, and a juice injector, 1, directly discharging into the cone and provided with a nozzle end having a number of tapering jet orifices formed so as to direct the injected juice in the form of a wall of jets having a central open zone.—J. F. B.

Preparation of phosphoric acid esters of carbohydrates. Ger. Pat. 292,817. See XX.

XVIII.—FERMENTATION INDUSTRIES.

Amylases; Products of the action of certain— upon soluble starch, with special reference to the formation of dextrose. H. C. Sherman and P. W. Punnett. J. Amer. Chem. Soc., 1916, 38, 1877—1885.

BOTH pancreatic and malt amylases, even when

highly purified, may produce small quantities of dextrose in the hydrolysis of starch, but under the conditions which obtain in the determination of diastatic power the dextrose formed is not sufficient to affect the results appreciably. Takadiastase, purified beyond the commercial condition, forms rather larger quantities of dextrose than the other amylases. In the hydrolysis of soluble starch with any of the three kinds of amylase, at 40° C., considerable amounts of dextrin remain even after 40–50 times as long as is required for the disappearance of the starch-iodine reaction, and about 1% of the "soluble" starch is left as a very finely divided insoluble residue difficult to filter.—J. H. L.

Starch as substrate for enzyme action; Experiments upon — H. C. Sherman and J. C. Baker. J. Amer. Chem. Soc., 1916, 38, 1885–1904.

The authors studied the action of different amylases on the two constituents of starch, α -amylase (amylpectin) and β -amylase, separated from each other by centrifuging potato-starch paste containing a trace of sodium chloride. The conversions were carried out at 40° C. and continued for 24 hours, low concentrations of enzyme being employed. Pancreatic amylase, both in commercial and in highly purified form, produced maltose more rapidly from β - than from α -amylase, and in both cases the substrate ceased to give the iodine reaction when about 35–50% of the theoretical quantity of maltose had been formed. The amylase of *Aspergillus oryzae* (purified takadiastase) hydrolysed Lintner's soluble starch, starch gelatinised in an autoclave, and α -amylase, at about equal rates; it hydrolysed β -amylase somewhat more rapidly but its action was not so well sustained as that of other amylases. The iodine reaction was lost when only 20–30% of the theoretical amount of maltose had been formed. Purified malt amylase produced maltose more rapidly from α - than from β -amylase during the earlier stages, but the rate of production from the former soon fell off whilst that from the latter was remarkably well sustained. The iodine test gave negative results only when 65–80% of the theoretical amount of maltose had been formed, in the case of Lintner's soluble starch, autoclaved starch, or α -amylase, and only when 85–95% had been formed in the case of β -amylase. The "delayed iodine end-point" appears to be characteristic of conversions effected by purified malt amylase, whether upon α - or β -amylase. With β -amylase as substrate, the amylase of *Aspergillus oryzae* catalyses the earlier stages of conversion more than the later stages; the converse applies to malt amylase, whilst pancreatic amylase is intermediate. With α -amylase all the amylases show a more pronounced catalytic effect in the earlier than in the later stages. Starch pastes made at low temperatures (65°–80° C.), autoclaved starch, and Lintner's soluble starch, all resemble α - rather than β -amylase in their behaviour as substrate towards all three amylases, doubtless because α -amylase is the chief component of all these forms of starch.

—J. H. L.

Yeast fermentation; Influence of catalysts (alkaloids, dyes, etc.) on — R. Somogyi. Int. Zeits. Phys.-Chem. Biol., 1916, 2, 416–429. J. Chem. Soc., 1916, 110, i., 619–620.

SMALL amounts of quinine and atropine accelerate the growth of yeast, whilst larger quantities inhibit it. With cocaine and pilocarpine, on the contrary, small amounts inhibit whilst larger quantities have an accelerating influence on the fermentation (compare Traube and Onodera, this J., 1915, 510). Basic dyes, such as Malachite Green and Methylene Blue, exert a toxic action on the yeast-cells when present in moderate con-

centration. When, however, only a trace of Methylene Blue is added, the activity of the yeast appears to be enhanced and fermentation is accelerated. Most of the acid dyes examined did not materially influence the rate of fermentation even when present in considerable amounts.

Sulphur in wine; States of combination of — and their determination. W. I. Baragiola and O. Schuppli. Z. Unters. Nahr. Genussm., 1915, 29, 193–221. J. Chem. Soc., 1916, 110, ii., 488.

SULPHUR occurs in wine principally as inorganic and organic sulphates; free and combined sulphurous acid, and "neutral" sulphur (sometimes called protein sulphur), are also present. A small quantity of free sulphur (partly colloidal) is found in some wines. Inorganic sulphuric acid is estimated by precipitation in the cold with barium chloride in an atmosphere of carbon dioxide; the organic sulphuric acid is estimated by heating the filtrate from the barium sulphate precipitate. Von der Heide's method (see this J., 1911, 566) is trustworthy for the estimation of the total sulphuric acid. The total sulphurous acid is estimated by distillation in the presence of phosphoric acid, whilst Mathieu and Billon's method (this J., 1902, 1247) may be used for the estimation of the combined sulphurous acid. For the estimation of total sulphur the wine is treated with sodium carbonate and hydrogen peroxide, evaporated to dryness, the residue mixed with potassium nitrate, and ignited; the sulphate in the ash is then estimated gravimetrically. "Neutral" sulphur is estimated by boiling the wine with hydrochloric acid to expel sulphur dioxide, precipitating the sulphuric acid with barium chloride, oxidising the filtrate from the barium sulphate with nitric acid, and precipitating the resulting sulphuric acid with barium chloride.

Methyl alcohol; Detection of — by Denigès' method. E. Salkowski. Z. Unters. Nahr. Genussm., 1914, 28, 225–236. J. Chem. Soc., 1916, 110, ii., 498.

IT has been found that many different alcoholic liquids yield a distillate which gives a reaction indicating the presence of methyl alcohol when tested by Denigès' method (this J., 1910, 583). Even when the distillate has been re-distilled before being tested, the result is not conclusive. A feeble reaction may be due to the presence of glycerol, but a strong reaction may be taken as indicating the presence of methyl alcohol, though confirmatory tests should always be applied.

Fermentation lactic acid; A study of the stereoisomerism of a — S. J. Thomas. J. Ind. Eng. Chem., 1916, 8, 821–823.

MATZOOK is an Armenian soured milk product prepared from cow's milk by the aid of a "starter" containing a bacillus of the *B. bulgaricus* group, resembling *B. caucasicus* (Flügge), *Streptococcus kefir*, Kuntze (a member of the *Str. lebanis* group), and *Saccharomyces kefir*. The lactic acid produced by Matzook in a synthetic culture medium was found to be optically inactive but could be resolved into the active modifications by fractional crystallisation of the strychnine salts.—A. S.

Total destruction of pentoses during alcoholic fermentation. Pellet. See XVII.

Biochemical synthesis of α -propyl-d-galactoside by means of an enzyme contained in air-dried bottom fermentation beer yeast. Bourquelot and Aubry. See XX.

PATENT.

Preparation of phosphoric acid esters of carbohydrides. Ger. Pat. 292,817. See XX.

XIXa.—FOODS.

Butter: Progressive oxidation of cold-storage —
D. C. Dyer. J. Agric. Res., 1916, 6, 927—951.

THE air contained in various samples of cold-storage butter was extracted and the carbon dioxide and oxygen contents determined, and at the same time the chemical characters of the extracted butter fats were in many cases also determined. The butter samples were placed in special tubes (9 × 1½ in.) with widened necks to carry a rubber bung fitted with a glass stop-cock, and the space between the butter and the bung was filled with pure paraffin oil. The air contained in a pasteurised sweet-cream butter containing bacteria and prepared from cream of acidity 0.11% (as lactic acid), underwent little or no change during 6 months at 0° F. (–18° C.), nor did the buttermilk made from the same cream. The composition of the air in the butter changed considerably when the temperature was 32° F. (0° C.), the oxygen diminishing and the carbon dioxide increasing progressively, and at room temperature this change was more marked. The air enclosed in butter made from sweet cream of acidity 0.25%, and churned immediately after the addition of 15% of a commercial starter, remained unchanged for 7 months at 0° F., but that from similar butter prepared with the addition of lactic acid suffered a progressive loss of both oxygen and carbon dioxide, the decreases being accentuated at 32° F., and the taste becoming unpleasant after 3 months. Buttermilk, from butter prepared similarly, lost all its enclosed oxygen in 26 days when it was exposed to a very large and confined surface of air; the carbon dioxide rose from 2.37% to 34% in the same time, but thereafter began to diminish. To investigate the oxidation of pure butter fat, the latter was separated and washed practically free from non-fatty constituents, and then stored for several months at 0° F. The samples showed no deterioration even after 18 months, and the chemical analyses, performed after 4 months, showed that no oxidation had occurred. The confined air, however, showed a slight progressive increase of carbon dioxide, which bore no relation to the oxygen content. Stored at 32° F., and exposed to a large surface of air, the fat underwent a slight oxidation. To ascertain if the changes in whole butter were due to its non-fatty constituents, samples made from pasteurised cream and ripened with a pure culture were (a) washed until the wash water was just clear, (b) more thoroughly washed, and (c) left unwashed. The keeping qualities at 0° F. of the two former were the same, as were also the chemical characters of the butter fats, and hence no chemical changes had occurred. The carbon dioxide enclosed in (a) decreased greatly in the second to third month, and then the decreased percentage remained fairly constant; that in (b) rose to a maximum after 3 months and then remained constant. In both samples, the oxygen content was different at each stage but it diminished regularly in both. Sample (c) was prepared similarly but from a different lot of cream, and it contained more buttermilk. Although the fat did not change during storage at 0° F. for 6 months, the confined air became very different from that in (a) and (b): the carbon dioxide was at a maximum after 3 months, when a characteristic "off flavour" developed, and after 8 months the oxygen content was reduced nearly to zero. The general conclusions arrived at were: Undesirable flavours in cold-storage butter are not due to oxidation of fat, but to a chemical change in one or more of the non-fatty ingredients; the extent of the change is proportional to the acidity of the cream from which the butter was made; the amount of confined carbon dioxide is probably related to the quantity of buttermilk present, and

this amount may increase to a maximum and then decrease progressively.—E. H. T.

Tallow and hydrogenated fats in butter fat; Detection of — K. Amberger. Z. Unters. Nahr. Genussm., 1916, 31, 207—308. Z. angew. Chem., 1916, 29, 1161, 411.

THE method depends upon the different solubility in ether of the glycerides of butter fat and of fats containing tristearin or β -palmitodistearin. 31 grms. of the clear melted fat at 40°–50° C. is placed in a warm 400 c.c. flask, which is then filled with ether, closed with a cork, shaken vigorously, and placed in a water-bath. After 1 hour it is again shaken, replaced in the water-bath for another hour, and shaken again. If there is no appreciable precipitate the butter fat contains less than 12% of tallow or the like. If a precipitate is present, it is collected on a filter, washed with 3–4 c.c. of ether containing 20% of alcohol, and weighed; if the weight amounts to 0.4 gm. or more the butter-fat is adulterated with a considerable proportion (15% or more) of tallow or the like.—A. S.

Rennet; Experiments on the preparation of home made — A. Todd and E. C. V. Cornish. J. Beard Agric., 1916, 23, 549—555.

THE rennet prepared from the dried vells of calves was of no practical value, but that made from fresh vells, although only half as active as the commercial extract, was of good quality and could be kept in good condition for at least six weeks in presence of a preservative. After splitting and emptying the vells, the skins were trimmed and washed well with cold water. They were then put into brine containing boric acid, and after 3 weeks' immersion (for vells from milk-fed calves) were transferred with the liquid on to cheese-cloths, which were pressed by hand and drained for several hours. The vells were then removed, the cloths pressed in a root press, and the liquid filtered several times through cotton wool. Apparently there was no advantage to be gained by using vells from very young calves, or by using sand, kieselguhr, or other filtering medium in addition to or in place of cotton wool. Prepared as above, the cost per gallon was about 6s. at current prices; that of commercial rennet is about 28s. It is not known if the coagulating property of the extract is due to rennet or to pepsin.—E.H.T.

Potato starch; Colorimetric method for the detection of — G. Rhneck. Z. Unters. Nahr. Genussm., 1915, 29, 246—247. J. Chem. Soc., 1916, 110, ii., 500.

THE presence of potato starch in flour may be detected by treating a portion of the latter on a microscope slide with a drop of water, drying it, adding a drop of a solution of the dyestuff, "meta-chrome red G Agta," washing off the excess of dyestuff, and then examining the slide under the microscope. Potato starch and cell tissues are coloured a bright golden yellow, whilst cereal starches are not coloured. The dye solution is prepared by cooling a solution of the substance in 30% alcohol, saturated at the boiling point, filtering, and diluting the filtrate with one-quarter of its volume of water. In presence of acids the dye colours wheat starch as well as potato starch; hence in applying the test to bread, it is necessary to treat a small quantity of the crumb with dilute alkali solution, and then wash it thoroughly, before adding the dye.

Soya beans; Salicylic acid reaction of — H. C. Brill. Philippine J. Sci., 1916, 11, 81—89.

SOME varieties of soya beans, particularly those grown in Japan, contain a substance which is soluble in alcohol and ether, volatile in steam,

crystallisable, and yields a violet coloration with ferric chloride in acid solution. The substance, which is probably Brand's maltol (this J., 1894, 896; 1895, 378), does not give a reaction with Jorissen's test for salicylic acid (a red coloration when the solution is heated with potassium nitrite, acetic acid, and a trace of copper sulphate). It appears to be formed by enzymic action in the beans. (See also Sherman, this J., 1910, 230; Backe, *ibid.*, 447, 970.)—W. P. S.

Tin in canned foods. W. D. Bigelow. J. Ind. Eng. Chem., 1916, 8, 813—815.

THE tin present in canned foods is largely and sometimes chiefly present in an insoluble form. Apparently the organic acids present in the foods dissolve tin from the container, and the tin compounds are subsequently hydrolysed in contact with the food, with separation of the tin in an insoluble form and liberation of acid. The hydrolysis is greater with non-acid or slightly acid foods than with acid fruits, but in both cases a considerable proportion of the soluble tin salts is carried within the solid particles of food before being hydrolysed. The proportions of tin (mgrms. Sn per kilo.) in the liquor and in the drained solids of various kinds of canned foods was found to be as follows:—cranberries, 33, 254; raspberries, 39, 294; cherries, 52, 163; peaches, 86, 251; pears, 99, 151; plums, 43, 180; shrimps, 67, 381; spinach, 35, 131; asparagus, 200—252, 322—554; Lima beans, 40—46, 99—254; string beans, 63—132; 169—658; wax beans, 39—88, 143—616. The relative proportion of the tin in the drained solids increases with the age of the sample. (Compare Buchanan and Schryver, this J., 1909, 322.)—A. S.

Ipel, a coffee substitute: *Leucana glauca* (Linnaeus) *Benth.* H. C. Brill. Philippine J. Sci., 1916, 11(A), 101—104.

IPEL-IPEL is a leguminous shrub growing widely in the Philippine Islands, the seeds of which are used there as a substitute for coffee. The roasted and ground seeds and their infusion have an aroma like that of coffee. The infusion appears brown by direct light and has a deep green fluorescence by reflected light. It gives a violet colour but no precipitate with ferric chloride, and reduces Fehling's solution after first acidifying with hydrochloric acid. The addition of copper acetate produces a green colour and a greenish-brown gelatinous precipitate, and lead acetate produces a yellow gelatinous precipitate. The infusion is slightly acid to litmus and gelatinises albumin. The specific gravity of a 10% decoction is 1.0068 and the content of dissolved solids 24.4%. Analyses of the raw and roasted seeds gave respectively: Moisture 14.80 and 8.13, fat 8.68 and 6.95, nitrogen 6.42 and 5.21, sucrose traces, nitrogen-free material other than fibre 9.78 and 16.11, crude fibre 22.29 and 22.18, ash 4.20 and 4.37%. The constants of the oil from the raw and roasted seeds are: $n_D = 1.467$ and 1.469, saponification value 196.2 and 190.7.—J. H. J.

Study of the stereoisomerism of a fermentation lactic acid. Thomas. See XVIII.

PATENTS.

Foods; Method of canning—F. Hugh, New York. Eng. Pat. 12,440, Aug. 30, 1915. Under Int. Conv., Sept. 30, 1914.

FOODS such as fruits, vegetables, meat, and fish, are placed in bags made of waterproof paper, which are loosely closed with wooden clamps. The filled bags are then placed in tins, water is added to fill the space between the bag and the tin, and the whole is subjected to a sterilising operation, during which the wooden clamps swell and close

the bags tightly; the tins are then sealed hermetically. The paper prevents the food coming into contact with the metal.—W. P. S.

Food for the feeding of agricultural stock; A milk-like—W. J. Melhuish, Poole, Dorset. Eng. Pat. 101,264, Apr. 25, 1916. (Appl. No. 5944 of 1916.)

To make 10 galls. of food, 8 galls. of water is heated to boiling in a jacketed pan, 2 galls. of lime water is poured in, and the source of heat removed. Then 160 grains of potassium or sodium phosphate is added and 16 lb. of pea nuts which have been coarsely ground is stirred in, with 100 grains of calcium chloride and 5 lb. of malted dextrin or other sweetening agent. About 200 grains of sodium bicarbonate, 250 grains of magnesium carbonate, and 100 minims of 50% butyric acid are also added. The pan is covered and the contents kept stirred for 20 mins., after which they are poured on to a cloth filter, and 20 grains of ammonium carbonate is stirred into the filtrate. When the temperature has fallen to blood heat, 120 grains of citric acid is added and the food stirred. Instead of pea nuts, any other starchless legume containing an edible oil may be used. The nuts may be blanched before use. To increase the amount of solid matter in the food, a portion, or the whole, of the insoluble matter of the nuts may be left in.—J. H. J.

Pasteurisation [of milk]; Process of—F. A. Haines. Assignor to D. C. Kerckhoff, St. Louis, Mo. U.S. Pat. 1,196,357, Aug. 29, 1916. Date of appl., Dec. 4, 1915.

MILK at 40° F. (4.5° C.) is passed through a coil at 185° F. (85° C.), whereby it is heated to 160° F. (71° C.) and remains at that temperature for 1—1 hr. It is then passed to a primary cooler where its temperature is rapidly reduced to 140° F. (60° C.) and where it remains for 20—30 mins., after which it is cooled further.—J. H. J.

Milk; Method of preserving—J. W. Davies, Boston, Mass. U.S. Pat. 1,197,270, Sept. 5, 1916. Date of appl., Jan. 24, 1916.

THE milk is pasteurised at a temperature sufficiently high to destroy bacteria, without changing the condition of the milk constituents, and is then transferred to containers whilst at substantially the same temperature. The milk is transferred to a hot room, kept at a permanent preservative temperature, between 140° and 152° F. (60° and 66° C.), whereby bacterial development is prevented, so that the milk may be maintained in stable condition for long periods of time.—B. N.

Preserving fruit-juices. C. E. Burke, Berkeley, and D. E. Fogg, Oakland, Cal. U.S. Pat. 1,197,442, Sept. 5, 1916. Date of appl., Oct. 3, 1914.

FRUIT-JUICES are clarified by treatment with "pith extract of a citrus fruit pith," together with a reagent promoting the coagulation of such extract.—B. N.

XIXE.—WATER PURIFICATION ; SANITATION.

Swimming pools; Chemical purification of—G. W. Heise and R. H. Aguilar. Philippine J. Sci., 1916, 11(A), 105—122.

EXPERIMENTS were made with copper sulphate and bleaching powder at swimming baths at Manila supplied with a river water which was impure and turbid from finely-divided clay, and which possessed a high degree of bicarbonate alkalinity. Copper sulphate added to the clean water in the bath failed to keep down the number of bacteria. Bleaching powder also failed when added in one large dose to the clean water, the

body secretions, particularly sweat, consuming a large amount of the chlorine added and preventing sterilisation. When bleaching powder was added daily in the amount of 0.5 part of available chlorine per million parts of water, the number of bacteria was kept below 200 per c.c., and *B. coli* was absent. The water could be kept fit for use for one and two weeks. No great change was produced in the chemical quality of the water as regards turbidity and oxygen absorption. The temperature of the water was 27°–30° C. One bath was in the open air and exposed to sunlight; the water in this bath consumed the available chlorine much more rapidly than the water in the indoor baths. The best chemical tests to judge the quality of the water were determinations of the free chlorine and of the consumption of free chlorine. The oxygen absorption test at the end of each week was proportional to the number of bathers.—J. H. J.

Antiseptics; Comparative action of — on pus and on pure cultures. A. Lumière. Comptes rend., 1916, 163, 309–311.

THE author studied the relative resistance to disinfection of pus from a shell-wound, containing white *Staphylococci* and broth cultures of the same organism. The antiseptics employed were phenol, hermophenyl (mercuri-phenoldisulphonate of sodium), and sodium hypochlorite, as representing respectively the groups of phenolic, metallic, and oxidising antiseptics. It was found that under the conditions of the experiments (action for 2 hours at 38° C.), the amount of hypochlorite required to sterilise pus was about 12 times as much as was required for an equal volume of broth culture. Hermophenyl and phenol showed far less difference of activity in the two media. The reduced bactericidal action of hypochlorite in pus is attributed to combination with organic matter; toxins present are oxidised and rendered innocuous to a greater extent by this antiseptic than by those of the phenolic and metallic groups. The experiments indicate that in the treatment of suppurating wounds with hypochlorite, relatively strong solutions should be used.—J. H. L.

PATENTS.

Water and other liquids; Treatment of —. S. H. Menzies, London. Eng. Pat. 13,987, Sept. 13, 1915.

THE reagent by which the water is to be treated is supplied by means of a small pump, preferably of a positive type, which has a by-pass between the suction and the delivery, so that on opening the valve on the by-pass, the delivery of the pump is reduced to an extent depending upon the degree of opening. This pump is mounted upon the same spindle as the main pump by which the water to be treated is passed through the treatment plant. The main pump delivers into a pressure tank, of such size that the water remains in contact with the reagent for the desired length of time. Into the outlet pipe from this tank, another small pump of the above type may deliver a determined quantity of another reagent, such as a de-chlorinating reagent.—J. H. J.

Water; Treatment of — for softening, purifying, and like purposes. H. J. Magrath, London. Eng. Pat. 17,133, Dec. 6, 1915.

A RECTANGULAR tank has a shallow layer of gravel on the bottom, over which is a deep layer of permutit or other base-exchanging material. The water enters by a valve, worked by a ball float, in the side of the tank, above the permutit, and stands at a level a little above the valve. It leaves by a three-way tap at the bottom. To regenerate the material a solution of salt is poured in at the top of the tank and allowed to trickle out through the

cock at the bottom. Alternatively, the tank may be filled with salt solution by upward displacement, a pipe being provided passing from the top of the tank to the bottom and along the floor, the portion along the floor being perforated and connected with a socket leading to the exit tap.—J. H. J.

Water-purifying apparatus. M. F. Newman, Oakmont, Assignor to W. B. Scaife and Sons Co., Pittsburgh, Pa. U.S. Pat. 1,195,391, Aug. 22, 1916. Date of appl., May 12, 1916.

THE apparatus consists of a treatment and settling tank, a gravity filter, and a purified water reservoir which is placed at a higher level than the filter. The inflow to the filter is controlled by a float valve operated by the level of the water over the filter, and the outflow from the filter is controlled by a float valve in the reservoir operated by the level of the water therein. The float operating the inlet valve is provided with a device for closing the outlet valve at a regulated minimum water-level in the filter. A system of pipes and valves is provided for washing the filter by a reverse flow of the purified water through the filter.—J. H. J.

Water-purifying apparatus. A. van Vloten, Denver, Colo. U.S. Pat. 1,195,537, Aug. 22, 1916. Date of appl., June 2, 1915.

THE apparatus consists of a precipitation tank, having at its lower end a funnel-shaped mixing compartment. The water and chemicals are supplied to the mixing compartment under pressure, and pass upwards between the edge of a conical baffle-plate and the side of the tank. Above the mixing compartment is an annulus of inverted V cross-section, spaced from the side of the tank, around which the upward flow of the liquids takes place. The upper portion of the tank is cylindrical and acts as a settling compartment. The top of the tank is closed and carries the exit pipe.—J. H. J.

Water; Process of purifying —. C. P. Hoover, Columbus, Ohio. U.S. Pat. 1,197,123, Sept. 5, 1916. Date of appl., July 11, 1916.

BAUXITE is treated with sulphuric acid in such proportion as to form a mixture containing basic aluminium sulphate, sulphuric acid, and the insoluble impurities of the bauxite. Water is added, and the resulting mixture is added to the water to be purified, thus forming aluminium hydroxide. This is settled with the entrapped impurities and the initial impurities of the bauxite, and the purified water drawn off for use.—B. N.

Sterilisation of liquids. M. von Recklinghausen, A. Helbrouner, and V. Henri, Paris, Assignors to The R.C.V. Co., Inc., New York. U.S. Pat. 1,196,481, Aug. 29, 1916. Date of appl., Dec. 21, 1912.

THE sterilising apparatus comprises a vapour electric lamp consisting of an enlarged non-luminous portion at one end, containing both electrodes, and a narrow luminous portion. The lamp is placed in the side of a sterilising chamber, so that the narrow portion projects into a tube in the chamber; the non-luminous part of the tube remains outside the chamber.—J. H. J.

Insecticides or plant washes. G. J. Lemmens, Watlingtonbury, and P. J. Fryer, Tonbridge, Kent. Eng. Pat. 161,308, Feb. 25, 1916. (Appl. No. 2856 of 1916.)

THE plant wash comprises two solutions. One is prepared from resin soap, which is rendered completely soluble by the addition of 15% of alcohol to the heated soap, or 75% of alcohol to the cold soap. Instead of alcohol, 30% of soap may be used, which, when added to the heated resin soap, produces a clear, non-setting liquid. This solution is added to the water with which the second

solution is to be diluted, in order to soften it. The second solution is the insecticide proper, and is made with soap as a basis.—J. H. J.

Nicotine solutions [dipping baths]; Method of testing —. R. G. Mewborne and H. K. McConnell. Assignors to The Kentucky Tobacco Product Co., Louisville, Ky. U.S. Pat. 1,197,142, Sept. 5, 1916. Date of appl., May 18, 1915.

THE nicotine content of dipping baths is determined by directly titrating a test portion of the solution, purified to remove interfering matter, with a standard solution of silicotungstic acid, in the presence of a suitable excess of mineral acid, but in the absence of an indicator.—B. N.

Water; Purification of —. H. Kriegsheim, Berlin. Assignor to The Permutit Co., New York. U.S. Pat. 1,197,640, Sept. 12, 1916. Date of appl., Aug. 11, 1914.

SEE Eng. Pat. 17,494 of 1914; this J., 1915, 885.

An improved fertiliser [from activated sewage sludge]. Eng. Pat. 8397. See XVI.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Digitalis group; Chemical constitution and pharmacological action of substances of the —. W. Straub. Biochem. Zeits., 1916, 25, 132—144. J. Chem. Soc., 1916, 110, i., 618.

THE lethal doses of the various glucosides of the digitalis group and their "genus" on frogs was determined, and also their relative actions in certain cases on the isolated hearts. The lethal doses are given in the following table, the results being expressed in grms. of drug per grm. of body-weight:—

Digitoxin	0.0000036	Digitoxigenin	0.000008
Strophanthidin	0.00000375	Strophanthidin	0.000025
Cymarigenin	0.0000008	Cymarigenin	0.000025

Digitalin and digitalenin were not sufficiently soluble for determinations of toxicity to be made. The glucosides are therefore more toxic than their genins. The toxicities of cymarigenin, cymarigenin (identical with strophanthidin), and cymaric acid, of which the chemical relationships to one another were determined by Windaus (this J., 1915, 851), were found to be 0.0000008, 0.0000025, and 0.00042 (in the same units). The benzoate of cymarigenin has a toxicity represented by the number 0.000025. No conclusions are drawn as to the relationship between chemical constitution and pharmacological action.

Rhamnus barks; Analysis of —. O. Tunmann. Apoth.-Zeit., 1915, 30, 642. J. Chem. Soc., 1916, 110, ii., 504.

THE red-coloured foam which is obtained when drugs containing anthraquinones are shaken with sodium hydroxide solution (compare this J., 1916, 906) is probably due to the presence of chrysophanol; the latter is present, therefore, in *Rhamnus carniolicus* as well as in *R. catharticus*, and the reaction simply serves to distinguish these from the American *rhamnus* bark, *R. purshiana*. Tschirch's colorimetric method indicates that the quantities of anthraquinone derivatives in *R. frangulus* and in *R. purshiana* have a ratio of 4:1, whilst according to the author's gravimetric method (this J., 1916, 273) the ratio between the two respective quantities is 3 or 2.5:1.

Vanilla beans; Effect of curing on the aromatic constituents of —. F. Rabak. J. Ind. Eng. Chem., 1916, 8, 815—821.

LABORATORY experiments were made on the effect on vanilla beans of different methods of curing.

Twelve lots of beans were used, of which six were cured at the ordinary temperature and six in a water-oven at 40°—60° C. Of each set of six, one lot was cured without any preliminary treatment and the others were first immersed, for the periods mentioned, three times successively in water at different temperatures, viz., for 30 secs. at intervals of 1 min. at 40° C., for 20 secs. at intervals of 1 min. at 60° C., and for 10 secs. at intervals of 1 min. at 80°, 90°, and 100° C. respectively. Extracts were prepared from the cured beans to afford a better basis for comparison. It was found that extracts prepared from beans cured at the ordinary temperature were superior in colour, odour, and taste to those prepared from beans cured at a higher temperature. The extracts in most cases were richer in vanilla resins and colouring matter than commercial extracts. In the preparation of the extracts a considerable proportion of the resins remained undissolved when the solvent had a lower alcohol concentration than 65%. It is concluded that the commercial curing process might with advantage be considerably shortened and simplified, and in order to produce uniformity in the composition of vanilla extracts it is recommended that the green beans be imported, and cured under uniform conditions. The best results appear to be obtained by curing at the ordinary temperature, either without previous treatment or after treatment with water at temperatures up to 90° C. for a short period. —A. S.

Deodar tree wood; [Constituents of the] volatile oil of Indian —. O. D. Roberts. Chem. Soc. Trans., 1916, 109, 791—796.

TWO samples of the volatile oil from the wood of Indian deodar tree (*Cedrus deodara*, Lond.; *C. libani*, Barr.) were of reddish-brown colour and characteristic balsamic odour and had the following constants: sp-gr. at 15° C., 0.8549 and 0.9756; n_D^{20} (100 mm. tube) = +52.16' and +34.6'; n_D^{25} = 1.5195 and 1.5225; acid value, 5.6 and 4.5; ester value, 19.3 and 4.9; ester value after acetylation, 30.8 and 34.4. The oil contains about 2% of a ketone, $C_{15}H_{30}O$, probably p-methyl-3,3-tetrahydroacetophenone, giving a semicarbazone, m.p. 163°—164° C., which on decomposition with dilute sulphuric acid and distillation with steam yields p-tolymethylketone; about 0.07% to 0.4% of an unidentified phenol giving a blood-red coloration with ferric chloride and forming a benzoyl derivative, m.p. 70° C.; 3% to 12% of the esters of hexoic, heptoic, and stearic acids; 50% to 70% of sesquiterpenes of variable rotation, together with sesquiterpene alcohols associated with high boiling, viscous decomposition products.—T. C.

Hydnocarpus venenata, Gaertner; *False chaulmoogra*. H. C. Brill. Philippine J. Sci., 1916, 11, 75—80.

THE kernels obtained from the seeds of *H. venenata* yielded, by expression, 51.2% of a greenish-yellow oil having the following characters:—sp. gr. at 30° C., 0.9475; m.p., 19°—20° C.; $[\alpha]_D^{20}$ = +52.03'; n_D^{20} = 1.4770; saponif. value, 200.3; acid value, 4.4; iodine value, 99.1. It contains a cyanogenetic glucoside, chaulmoogric acid, and hydnocarpic acid. The oil closely resembles true chaulmoogra oil obtained from *Taraktogenos Kurzii*, and also the oils obtained from *H. Wightiana* and *H. anthelmintica* (see this J., 1904, 689; 1905, 741). Since the chemical constituents are identical, it is probable that chaulmoogra and hydnocarpus oils would have the same physiological properties; gynocardia oil, which is optically inactive, might be different, depending on whether the physiological activity is due to the unsaturated acids present in the chaulmoogra

and hydnocarpus oils or to the glucoside present in all the seeds.—W. P. S.

Thymol from Monarda punctata. E. M. Holmes. Perf. and Essent. Oil Rec., 1916, 7, 311—312.

EXPERIMENTS have been made in the United States (Dept. Agric. Bull. No. 372) on the cultivation and exploitation of *Monarda punctata* as a source of thymol, this plant being considered more suited to the particular circumstances than the Indian plant "Ajowan" (*Carum copticum*) which serves as the raw material for the extraction of thymol in Germany. The seeds of *Monarda* used for the experiments gave rise to two varieties of plants: dark plants with more serrate leaves and a pronounced red coloration in stems and branches, and light green plants with larger leaves, practically free from red coloration. The average yields of oil were 0.40% from the dark plants testing 66% of phenols, and 0.42% from the light plants testing 69% of phenols. The light plants also produced more leaves. Cultivation of this type in subsequent years showed in some crops an increased yield of oil up to 0.44%, and phenol contents up to 72—74%. Particulars of cultivation are given. The best results were obtained on rich, well drained sandy loam underlain with marl or calcareous clay at a depth of 2—3 ft.; the plant requires a good supply of lime. Cutting should be performed in the flower-bud stage and the herb taken to the distillery without drying. The distillation water, relatively rich in phenols, is reserved and added to the next batch of herb for distillation. The crude oil contains a small quantity of carvacrol and some cymene and, in the manufacture of thymol, the crude product is fractionated. The thymol is separated from the fraction boiling between 215° and 240° C., a crystal of thymol being added to induce crystallisation. With systematic working of the fractions, a commercial yield of 66.3% of white crystallised thymol is obtained. It is calculated that from a first year's crop, 20 lb. of oil per acre may be expected and from subsequent crops 30 lb. or even 40 lb. of oil per acre. The expenses of cultivation are estimated at \$23 per acre for the first year and \$19 for subsequent years; replanting will not be required oftener than once in five years. The average profit over a period of five years is estimated at \$16 per acre.—J. F. B.

Vitamines: Chemistry of the —. R. R. Williams. Philippine J. Sci., 1916, 11, 49—57.

The following method was employed for obtaining "vitamine" from rice polishings. Twenty-five kilos. of the polishings was macerated with alcohol containing hydrochloric acid, the liquid then pressed out, concentrated at a low temperature under reduced pressure, and the aqueous portion separated from the layer of fat. This aqueous portion was treated with phosphotungstic acid, the precipitate collected, washed with dilute sulphuric acid, air-dried, mixed with excess of barium hydroxide, and the mixture extracted with water; the extract was freed from barium and sulphuric acid, neutralised with nitric acid, concentrated under reduced pressure, and then treated with silver nitrate. The precipitated purine bases were separated, the solution treated with a further quantity of silver nitrate and an amount of barium hydroxide sufficient to produce a permanent precipitate; the latter was collected, decomposed with hydrogen sulphide, the silver sulphide separated, barium present was removed as sulphate, and the solution then concentrated and treated with twice its volume of alcohol. A precipitate formed which had slight curative properties when administered to fowls suffering from beri-beri; it contained a considerable quantity of nicotinic acid. The solution from this

precipitate was evaporated over sulphuric acid at ordinary pressure; a small quantity of crystals formed on the surface of the liquid, the yield being about 35 mgrms. These crystals had m.pt. 223° C., and had pronounced curative powers. About 0.2 grm. of amorphous material, having curative powers, also separated as the liquid was concentrated; when the latter was evaporated completely, a film weighing 0.25 grm. was obtained which had moderate curative powers. The effects of nicotinic acid and its derivatives on neuritic fowls were also determined. Nicotinic acid, trigonellin, and *p*-hydroxynicotinic acid effected little improvement; the hydrochloride of the methyl ester of nicotinic acid produced a marked but temporary improvement.—W. P. S.

α -Propyl-d-galactoside; Biochemical synthesis of — by means of an enzyme contained in air-dried bottom-fermentation beer yeast. E. Bouquelot and A. Aubry. Comptes rend., 1916, 163, 312—315. (See this J., 1915, 159.)

THREE litres of solution, containing 30 grms. of galactose, 750 grms. of propyl alcohol, and 600 c.c. of maceration juice from bottom-fermentation yeast, yielded after 8 months at the ordinary temperature, 2.1 grms. of crystalline α -propyl-galactoside.—J. H. L.

Alkylamines: Preparation of —. H. Krause. Chem.-Zeit., 1916, 40, 810.

HAVING recently devised a practical process for the preparation of the nitroparaffins, the author has studied the reduction of these bodies to alkylamines by iron and hydrochloric acid by a process similar to that employed in the manufacture of aniline. It is known that the reduction of nitrobenzene may be effected with only $\frac{1}{3}$ of the theoretical quantity of hydrochloric acid and that the mixture remains acid throughout, owing to the weakly basic character of the aniline. The alkylamines are stronger bases, and when working with a fractional proportion of hydrochloric acid ($\frac{1}{3}$ of the theoretical) at 50°—60° C., the acid reaction soon disappears and ferrous hydroxide is precipitated, becoming oxidised later to the ferric condition. The liquid acquires an increasingly alkaline reaction and an ammoniacal odour. Thus the reduction of the nitroparaffins proceeds in an alkaline medium but less energetically than at first, and since the liquid contains no trace of iron salt in solution it is inferred that the reduction is effected by the nascent hydrogen produced by the action of the amine hydrochloride on the metallic iron, analogous to the action of ammonium chloride. This view is supported by the fact that iron and water alone have no action on the nitroparaffins, but if a little alkylamine hydrochloride be added, reduction sets in. The reduction of nitromethane with iron and $\frac{1}{3}$ of the theoretical quantity of hydrochloric acid for 6 hours gave a yield of 75% of the calculated quantity of amine; in 3 hours the yield was only 58%. The reduction, however, proceeds more energetically and completely when a larger proportion of acid is employed; for instance, with 1.5 mol. of acid to 1 mol. of nitromethane (theoretical proportion 7:1) the reduction is practically complete after 1 hour at 70° C. and the yield of methylamine is nearly quantitative; the reduction of nitroethane under similar conditions requires a longer time but the yield is practically as good.—J. F. B.

Ether for anaesthesia: Determination of small amounts of alcohol and water in —. E. Mallinckrodt, jun., and A. D. Alt. J. Ind. Eng. Chem., 1916, 8, 807—812.

To determine water, the ether is dehydrated with a known weight of anhydrous potassium carbonate.

If alcohol also is present, some is retained by the potassium carbonate and vitiates the results, but it can be removed by washing two or three times with pure anhydrous ether before drying and re-weighing. If the specific gravity of the ether after dehydration with potassium carbonate be determined, the alcohol content can be read directly from a curve. A curve is given for the values at 25° on the hydrogen scale. It is nearly a straight line; the average values for pure anhydrous ether and for ether containing 3% of alcohol are 0.70987 and 0.71301 respectively. Five samples of commercial anaesthesia ether gave the following results:—

	1	2	3	4	5
Water, %	1.08	1.21	0.12	0.36	0.26
Alcohol, %	1.42	0.85	0.12	4.25	0.32

Alcohol had probably been added to sample No. 4. It is questionable whether ether complying strictly with the requirements of the U.S. Pharmacopoeia (that it shall consist of 96% of ethyl oxide and 4% of alcohol containing a little water) can be made by the usual distillation process.—A. S.

Linseed mucilage as protective colloid. Colloidal gold. A. Gutbier, J. Huber, and E. Kuhn. *Kolloid-Zeits.*, 1916, 18, 201—210, 263—273. *Z. angew. Chem.*, 1916, 29, Ref., 409.

THE mucilage is prepared by shaking linseed for 1 day at the ordinary temperature with water saturated with chloroform, and filtering through flannel and glass-wool. The substance may be purified by treating the solution with twice its quantity of absolute alcohol, dissolving the precipitate in water saturated with chloroform, and dialysing. Stable colloidal gold solutions were prepared by reducing gold chloride with hydrazine hydrate, formaldehyde, sodium hydrosulphite, or phenylhydrazonium chloride in presence of linseed mucilage. To obtain solid products from the colloidal gold solutions it was necessary to evaporate *in vacuo* over concentrated sulphuric acid, as only incomplete precipitation took place on addition of strong alcohol.—A. S.

Identification of phenols by the spectroscope. Gsell. See III.

Quartz glass apparatus for bacteriological and surgical work. Paul. See VIII.

Influence of catalysts (alkaloids, dyes, etc.) on yeast-fermentation. Somogyi. See XVIII.

Detection of methyl alcohol. Salkowski. See XVIII.

Titrimetric studies. [Titration of hydrogen peroxide and diethylbarbituric acid.] Enell. See XXIII.

PATENTS.

Hog cholera serum globulin; Preparations of —, and process of producing same. P. M. Justice, London. From H. K. Mulford Co., Philadelphia, U.S.A. Eng. Pat. 101,275, May 31, 1910 (Appl. No. 7735 of 1910). Addition to Eng. Pat. 6604, May 3, 1915 (this J., 1910, 653).

THE process described in the principal patent is modified by treating the hog cholera antitoxin with a reagent other than one which forms an insoluble hydroxide, e.g., ammonium sulphate, so that the resulting mixture contains about 25% of the reagent, adding kieselguhr or other inert silicious earth, and filtering the mixture under pressure. The percentage of the reagent in the filtrate, which contains the hog cholera antibodies and globulins, and serum albumin, is then increased to about 50%, which causes precipitation of the globulin and hog cholera antibodies. These are separated by filtration from the serum albumin,

which is discarded. The precipitate is freed from excess of the reagent by pressure, and may be dried, dialysed, or dissolved and sterilised by filtration. —F. Sp.

Amyl acetate; Process of making —. H. Essex and B. T. Brooks, Assignors to Gulf Refining Co., Pittsburgh, Pa. U.S. Pat. 1,497,019, Sept. 5, 1916. Date of appl., Dec. 8, 1915.

PENTYL chloride, or the monohalogen derivative of a gasoline fraction of b.pt. 25°—45° C., is heated under pressure in a rotary container with an alkali salt of an organic acid, e.g., an acetate, so that the mixture is forcibly agitated during heating. —J. F. B.

Phosphoric acid esters of carbohydrates; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 292,817, Feb. 26, 1915.

IN the preparation of phosphoric acid esters from fermentable carbohydrates and inorganic phosphates by the action of yeast enzymes (see Fr. Pat. 458,096 of 1913; this J., 1913, 1031), it is customary to heat the mixture in order to destroy the enzyme when the ester formation is complete. This method has the disadvantage that part of the ester is thereby decomposed, so that on subsequently treating with a calcium salt, the calcium salt of the ester is contaminated with calcium phosphate. According to the present patent the enzymic activity is destroyed by addition of tannic acid, which also precipitates proteins. A higher yield of the ester is obtained, and the product is purer than that obtained by the older method.—A. S.

Halogenhydroxyquinolines; Preparation of derivatives [metallic lakes] of —. Soc. Chem. Ind. in Basle. Ger. Pat. 292,819, Nov. 22, 1913.

METALLIC lakes, e.g., the calcium, zinc, and cerium lakes, of halogenhydroxyquinolines are prepared by precipitation methods, in presence of suitable carriers if so desired. The method is especially suitable for the preparation of antiseptic dressings (bolus, kieselguhr, or the like impregnated with the lakes mentioned) for the dry treatment of wounds. —A. S.

4-Hydroxypiperidine and its N-alkyl derivatives; Preparation of derivatives [esters] of —. B. Emmert, Würzburg. Ger. Pat. 292,846, Dec. 8, 1914.

ORGANIC acid esters of 4-hydroxypiperidine and its N-alkyl derivatives are prepared by the usual methods. They are of value as local anaesthetics and as mydriatics. Examples mentioned are the benzoic and p-toluic esters of 4-hydroxypiperidine, and the o- and p-toluic and p-nitrobenzoic esters of N-methyl-4-hydroxypiperidine.—A. S.

Alkali-acetones and hydroxyisopropyl derivatives of hydrocarbons; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 293,059, July 14, 1914.

ALKALI-ACETONES are obtained by the action of diacetonealcohol or triacetonealcohol on potassium or sodium or an alkali amide below 6° C. The alkali-acetones may be used for the preparation of hydroxyisopropyl derivatives of hydrocarbons or their derivatives, as described in Ger. Pat. 280,226 and Fr. Pat. 474,745 (this J., 1915, 378, 1116), or the two processes may be combined in a single operation.—A. S.

Acetaldehyde from acetylene; Preparation of —. Farb. vorm. Meister, Lucius, u. Brünig. Ger. Pat. 293,070, Apr. 24, 1914. Addition to Ger. Pat. 292,818.

METALLIC mercury in presence of dilute acid is used instead of the mercuric salt specified in the

chief patent (see U.S. Pats. 1,151,928 and 1,151,929 of 1915; this J., 1915, 1031).—A. S.

Alkyl esters of 1-aryl-4-diethylaminoethyl-5-pyrazolone-3-carboxylic acid; Preparation of —. Farb. v. m. Meister, Lucius, u. Brüning. Ger. Pat. 293,287, May 12, 1915.

THE hitherto unknown alkyl esters of 1-aryl-4-diethylaminoethyl-5-pyrazolone-3-carboxylic acid, $(C_2H_5)_2N.(CH_2)_x.CO < \begin{smallmatrix} C(COOR):N \\ CO-(Aryl)N \end{smallmatrix}$

have been found to possess pronounced anæsthetic properties. They are obtained by treating esters of 1-aryl-5-pyrazolone-3-carboxylic acid, preferably in the form of their alkali salts, with halogen-diethyldiamines.—A. S.

Aluminium alkylloxides; Preparation of —. Farbwerke vorm. Meister, Lucius, u. Brüning. Ger. Pat. 293,613, Dec. 24, 1913. Addition to Ger. Pat. 286,596 (this J., 1915, 1168).

THE higher homologues of ethyl alcohol are caused to interact with metallic aluminium in presence of a very small quantity of a mercuric salt. The reaction may be started with a portion of the aluminium and the remainder added at intervals. The aluminium alkylloxides are soluble in the alcohols from which they are derived and may be recovered in a pure condition by crystallising or by distilling off the alcohol.—A. S.

Mercury chloroaminoglycerol compound; Preparation of a —. B. Börner, Hanover. Ger. Pat. 293,092, Mar. 14, 1913.

A solution of mercuric chloride in glycerol is precipitated with ammonia in presence of water, or freshly-precipitated hydrous mercuric amino-chloride (infusible white precipitate) is treated with glycerol, with or without the aid of pressure and heat. The product is soluble in weak acids, such as butyric acid, has no irritant action on the skin, and, in the form of ointment, is of value for the treatment of syphilis.—A. S.

Hog-cholera serum globulin; Process of producing —. J. Reichel, Assignor to H. K. Mulford Co., Philadelphia, Pa. U.S. Pat. 1,197,150, Sept. 5, 1916. Date of appl., May 27, 1915.

SEE Eng. Pat. 101,275 of 1916; preceding.

Method of testing nicotine solutions. U.S. Pat. 1,197,142. See XIXB.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Photographic images; Process for the simultaneous toning and fixing of silver —. A. Spitzer and L. Wilhelm, Vösendorf, Austria. Ger. Pat. 292,352, May 7, 1914.

TELLUROUS or telluric acid or their salts, especially the sodium salts, are used in admixture with sodium or ammonium thiosulphate, etc., for the preparation of combined toning and fixing baths.—A. S.

Photographic materials (plates, films, paper, etc.) with addition of a dye by which the light-sensitiveness is reduced. G. W. A. Sosna and J. E. Biedebach, Bremen. Ger. Pat. 292,723, July 20, 1915. Addition to Ger. Pat. 288,328.

IN addition to the dyestuffs mentioned in the chief patent (this J., 1916, 386), a substance, such as phenolphthalein, is used which has no effect on the emulsion, but combines with a constituent of the developer, e.g., the alkali, to form a coloured

compound which protects the emulsion from the action of diffused daylight during development.—A. S.

Multicoloured screens for colour photography; Production of —. C. Schleussner A.-G., Frankfurt. Ger. Pat. 293,004, Oct. 15, 1914.

THE screen is prepared with the aid of particles of a colloidal substance stained in different colours and the particles are subsequently caused to coalesce by exposure to the vapour of a suitable swelling agent.—A. S.

XXII.—EXPLOSIVES; MATCHES.

Explosives in coal mines. Order of Sept. 21, 1916.

Two explosives, of the composition given below, have been added to the list of "Permitted Explosives":—

Ingredients.	Parts by weight.			
	Super-Chliffite No. 1.		Super-Chliffite No. 2.	
	Not more than	Not less than	Not more than	Not less than
Nitroglycerin ...	10.5	8.5	10.5	8.5
Nitrocotton	0.75	0.25	0.75	0.25
Ammonium nitrate	60	57	60.5	57.5
Sodium chloride	16	14	20.5	18.5
Ammonium oxalate	11	9	6	4
Wood meal (dried at 100° C.) ..	6.5	4.5	6.5	4.5
Moisture	2.5	0.5	2.5	0.5

The usual restrictions as to packing, etc., are included. Four ounces of either of the above explosives gave a swing of 2.53 in. to the ballistic pendulum, compared with a swing of 3.27 in. given by four ounces of gelignite containing 60% of nitroglycerin.

PATENT.

Match making machinery. A. Kelley, Wilmington, Del., U.S.A. Eng. Pat. 13,378, Sept. 20, 1915.

XXIII.—ANALYSIS.

Hydrocyanic acid; Investigation of the chief methods of detecting —. G. Anderson. Z. anal. Chem., 1916, 55, 459—468.

THE relative delicacy of the principal tests for hydrocyanic acid was determined on 10 c.c. portions of solutions of 98.5% potassium cyanide. With a 0.01% solution (0.000393 grm. CN), a N/20 solution of silver nitrate and 20% nitric acid still produced a precipitate; the limit was reached with a 0.0001% solution (1 pt. HCN in 215,000), when the turbidity was visible only when viewed through a column 12 cm. high against black paper. In this test, it is advantageous to use an excess of silver nitrate. In the Prussian blue test, a precipitate was obtained with a 0.01% solution, but only a coloration at greater dilutions. The most dilute solution which gave the test was 0.001% (1 pt. HCN in 24,500). The conversion of cyanide into ferrocyanide is probably incomplete. The identification as ferric thiocyanate is possible with a 0.0001% solution. The test was performed by adding 3 drops of ammonium sulphide and 2 drops of N/1 caustic soda to 10 c.c. of the cyanide solution, evaporating to dryness on the water-bath, dissolving the residue in water and 3 drops of N/1 hydrochloric acid, and adding 5 drops of a 1% ferric chloride solution. The addition of a 15% caustic potash solution

and a few c.c. of a cold saturated solution of picric acid, produces a red coloration, but the limit is reached with a 0.01% solution of cyanide. The test is uncertain and is not recommended. The presence of hydrocyanic acid is indicated by the production of a blue colour on paper steeped in a 4% guaiacum tincture and 0.25% copper sulphate solution, or, better, in the liquid itself; but a 3% solution of guaiaconic acid and a 1:1000 copper sulphate solution is to be preferred. The weakest solution that gave the reaction was a 0.00001% solution (1 pt. HCN in 2,450,000). Certain other substances, e.g., ammonia and cigar smoke, however, produce the same effect.—E. H. T.

Soap as indicator in volumetric analysis. [Titration of solutions of colouring matters.] J. F. Sacher. Seifenfabrikant, 1916, 36, 289–290. Z. angew. Chem., 1916, 29, Ref., 329.

IN the acidimetric or alkalimetric titration of solutions of colouring matters and the like, where the use of ordinary indicators is unsatisfactory, good results may be obtained by using soap solution as indicator. The soap solution is prepared by saponifying linseed oil with excess of potassium hydroxide solution and exactly neutralising with dilute acid; 1 c.c. of soap solution is used for 100 c.c. of the solution to be titrated. It is stated that the production of a turbidity in presence of free acid and disappearance of the turbidity in presence of free alkali are sufficiently sharp and rapid even at the ordinary temperature and in artificial light.—A. S.

Titrimetric studies. [Titration of hydrogen peroxide, diethylbarbituric acid, and hydrogen sulphide.] H. Enell. Z. anal. Chem., 1916, 55, 452–459.

WHEN titrating in presence of hydrogen peroxide, iodo-eosin or dimethylaminoazobenzene are more satisfactory indicators than phenolphthalein. Titrations of commercial hydrogen peroxide with $N/10$ potassium hydroxide gave a considerably higher result with the latter indicator than with the two former; the sample contained hydrochloric acid, and probably phosphoric acid and citrophene (triphenetidine citrate). Iodo-eosin, in presence of ether, is a most sensitive indicator and its use should be extended; the error caused by the loss of a little material when the bottle is opened after shaking can be obviated by using a rubber bung. It is excellently adapted for the titration of diethylbarbituric acid (veronal) with caustic soda, whereby the stable monosodium salt is formed. In the estimation of hydrogen sulphide with silver nitrate, some of the silver sulphide formed remains in colloidal solution and obscures the end-point of the subsequent titration with thiocyanate solution in presence of ammonium iron alum. This can be counteracted by adding $N/10$ sodium chloride solution, in amount about equal to that of silver nitrate solution, and filtering through cotton wool, allowance being made in the calculation for the amount so added. The presence of glycerol in an aqueous solution of hydrogen sulphide was found greatly to increase its keeping quality, thus confirming an old observation of Lepage (1867). The stability of the solution is increased to a small extent by adding 50% or 90% alcohol, and to a greater degree by adding ether. The solubility of hydrogen sulphide, in vols. per unit volume of solution, was found to be 2.6 for water, 1.87 for glycerol and water (1:1), 2.9 for 50%, 8.26 for 90% alcohol, and 14.46 for ether.—E. H. T.

Calcium in presence of strontium and barium; Detection of —. P. N. Raikow. Chem.-Zeit., 1916, 40, 781.

THE material (0.5–1 gm.), as alkaline-earth

carbonate, is heated for a few minutes in an open porcelain crucible over a Bunsen burner, the product stirred, when cold, with a few c.c. of water, the mixture filtered, and the filtrate tested with phenolphthalein. An alkaline reaction indicates the presence of calcium. Under the conditions specified, strontium and barium carbonates are not altered, but calcium carbonate is readily decomposed, as little as 0.2% being detected with ease.—F. SODN.

Zinc; Determination of — by Schaffner's method. J. Patek. Z. anal. Chem., 1916, 55, 427–452.

VARIOUS objections to the Schaffner method of zinc determination (Nissenson, this J., 1896, 52; Greenwood and Brislée, this J., 1909, 1138) were examined experimentally and disproved. Thus it was shown that it is not necessary that the standard zinc solution and the solution to be determined should contain the same amount of zinc; that the quantities of ammonia present in the two zinc solutions immediately before titration vary only within narrow limits; and that the maximum amount of ammonia present is much less than the quantity which adversely affects the analytical result. Further, the accuracy of the method is not influenced by the use of different acids in varying concentrations to dissolve the ore or the pure metal, nor by varying the kind of oxidising agent employed. Results are affected neither by the nature nor by the amount of the ammonium salt present. Lastly, Decker's contention (this J., 1906, 911) that freshly precipitated zinc sulphide interacts with ammonium salts in neutral or ammoniacal solution, could not be confirmed.—E. H. T.

Molybdc acid and ammonium nitrate; Recovery of — from the residues from phosphoric acid determinations. A. Grete. Schweiz. Ver. anal. Chem., May 26 and 27, 1916. Chem.-Zeit., 1916, 40, 813.

THE residues from the gravimetric and volumetric processes contain, besides nitric acid, quantities of other acids, such as sulphuric acid, and salts of iron, aluminium, calcium, magnesium, and alkali metals. For the treatment of the residues, 10 litres of the acid liquid is neutralised with ammonia and re-acidified with 10 litres more of the residual liquors. The liquid is heated, and decanted from the yellow precipitate which forms; the sulphuric acid is precipitated by barium nitrate and the liquid made alkaline with ammonia and ammonium carbonate. The ferric hydroxide and alkaline earths are thus separated and the liquid then contains only small quantities of molybdc acid and the alkali salts as impurities. If the molybdc acid must be separated, yellow ammonium sulphide is added in not too large excess to the warm liquid until a dark reddish-yellow colour is produced. After cooling, dilute nitric acid is added carefully until a dark brown precipitate of molybdenum sulphide settles out from a perfectly colourless solution on stirring. The filtrate is then evaporated and ammonium nitrate is recovered by crystallisation. The last mother liquors, which are dark in colour and contaminated with alkali salts, may be used as a fertiliser. If the crystals of ammonium nitrate are to be used again for phosphoric acid determinations, it is not necessary to separate the molybdc acid by ammonium sulphide, but the final mother liquors should be so treated.—J. F. B.

Use of ammonium nitrate in determining the calorific power of lignites. Salvadori. See II.

Colorimetric determination of acetylene. Schulze. See II.

Identification of phenols by the spectroscope. Gsell. See III.

A new method of measuring the refractive index and dispersion of glass. Cheshire. See VIII.

Quartz glass apparatus for bacteriological and surgical work. Paul. See VIII.

Rapid method for the determination of manganese [in steel]. Szász. See X.

Platinum and illuminating gas. Mylius and Hüttner. See X.

Quantitative analysis of antimony trisulphide and the products obtained from it by roasting. Von Bacho. See X.

Determination of glycerol in fatty oils by means of sodium glycerate. Bull. See XII.

Marcusson-Schilling's modification of Bömer's method for the detection of phytosterol by precipitation with digitonin. Olig. See XII.

Determination of phytosterol in vegetable fats. Klostermann and Opitz. See XII.

The Liebermann-Storch colour test for rosin. Jameson. See XIII.

Determination of total sulphates in leather. Levi and Orthmann. See XV.

Determination of the basicity of chrome tanning liquors. Appelius and Schmidt. See XV.

Precipitation of reducing sugars by basic lead acetate. Deerr. See XVII.

Total destruction of pentoses during alcoholic fermentation. [Analysis of molasses.] Pellet. See XVII.

States of combination of sulphur in wine and their determination. Baragiola and Schuppli. See XVIII.

Detection of methyl alcohol. Salkowski. See XVIII.

Detection of tallow and hydrogenated fats in butter fat. Amberger. See XIXa.

Colorimetric method for detection of potato starch. Blumk. See XIXa.

Salicylic acid reaction of soya beans. Brill. See XIXa.

Analysis of Rhamnus barks. Tunmann. See XX.

Determination of small amounts of alcohol and water in ether for anaesthesia. Mallinckrodt and Alt. See XX.

PATENTS.

Pyrometer-scale. G. A. Shook, Urbana, Ill., Assignor to Scientific Materials Co., Pittsburgh, Pa. U.S. Pat. 1,196,306, Aug. 29, 1916. Date of appl. Oct. 2, 1913.

A total radiation pyrometer has a scale calibrated to represent true temperatures, based on the formula, $\log T = \log T_0 + k$, in which T represents the true and T_0 the black-body temperature of the hot body, and k a constant depending upon the material of which the hot body is composed. —W. E. F. P.

Temperature of incandescent bodies; Apparatus for observing chemical processes and for determining the —. Ströhlein und Co. Ges.m.b.H., Düsseldorf. Ger. Pat. 293,668, May 26, 1915.

A tube connected at one end with the apparatus in which the substance to be examined is heated, is closed at the other end by a lens. At this latter end the tube is connected with one limb of an

inclined V-shaped tube, the other limb of which is provided with a lens and a coloured disc and is connected with the tube of an optical pyrometer. The light rays from the object under examination are reflected into the pyrometer tube by a mirror placed in the angle of the V-tube.—A. S.

Method of testing nicotine solutions [dipping baths]. U.S. Pat. 1,197,142. See XIXb.

Trade Report.

Chemical industries of Switzerland and the war. Chem.-Zeit., 1916, 40, 745—747.

The industries of Switzerland have suffered principally through withdrawal of labour on mobilisation and difficulty in importing raw materials. The Swiss exports for 1915 reached a total value of 1670 mill. frs., as against 1186 mill. frs. for 1914; the imports (value 1680 mill. frs.) were lower than in 1914. In the heavy chemical section, the works at Uetikon is the only one concerned in the manufacture of acids, using imported pyrites, and the supply of vitriol has been inadequate. As regards soda ash, the scarcity of imported supplies has stimulated the erection of a large new works at Zurzach. The most pressing scarcity has been felt in nitrogenous fertilisers; Chili saltpetre is unobtainable and the production of ammonium sulphate very inadequate, in spite of the stoppage of the exportation of ammonia liquor. Most of the glass factories are shut down, but the Monthey works reopened at the end of 1914 and is probably accumulating stock. The fine chemical industry is much hampered through lack of materials. There is a strong demand but exports are prohibited, except where ample supplies are demonstrated. The transport difficulties through the port of Genoa are extremely great, prices are very high, and the supply of materials is obtained entirely from Entente and a few neutral countries. In the electrochemical section conditions are more satisfactory. The carbide factories continue to work, with selling prices about 20% above normal. Calcium cyanamide, carborundum, and abrasite are being manufactured for export. The manufacture of chlorates is hampered by the German prohibition of the export of potassium chloride. The electrolytic caustic soda industry is unaffected by the war and the sale of bleaching powder has considerably increased. The manufacture of nitric acid from the air is greatly stimulated and a certain amount is available for export at double the normal price. The aluminium and iron-alloy industries are stimulated by strong demand and high prices, but greatly hampered by the difficulty of importing raw materials. The dyestuff industry has had to cope with great difficulties in connection with labour and materials. There are no coke ovens in Switzerland and the coal-tar products procurable have only been those which could be spared by belligerent countries, chiefly England, after the satisfaction of the explosives' demand; there is only one sulphuric acid works, but recently there has been Government encouragement for the scheme for the erection of a common acid plant for the dyestuff factories. Nitrites, nitric acid, caustic soda, and chlorine are plentiful. The Swiss dyestuffs factories have had to supply the requirements of the home consumers, who formerly dealt almost entirely with Germany and who are now busy with foreign orders; nevertheless a considerable quantity has been exported under Government supervision in return for raw materials allowed to come in; the price of aniline oil has risen to 10 times the normal. The Swiss silk-dyeing industry is suffering severely through scarcity of vegetable dyestuffs, particu-

ogwood; stocks are nearly exhausted and supplies non-existent, since England and America absorb the whole production. The mechanical wood pulp mills complain of weak demand; the demand for cellulose is very keen but the production is hampered through scarcity of chemicals and transport difficulties. The paper industry is oppressed by general troubles. The market for industrial explosives is weak; the match factories are overburdened with demands but experience great scarcity of materials; prices have risen 50%. Imports generally are supervised by organisations acting on behalf of both groups of belligerents. Whereas the German organisation is said to be working smoothly and satisfactorily, the Entente trust is having considerable trouble and friction, particularly over the question of cotton goods and the general difficulties connected with transport through France and Genoa.—J. F. B.

Electro- and organic-chemical industries of Russia.
Chem. Trade J., 1916, 59, 263—264.

OWING chiefly to lack of raw material, cheap sources of electrical energy, and available capital, Russia has been hitherto mainly dependent on foreign countries for electrochemical products. For the economic production of calcium nitrate, aluminium, ferrosilicon (50% Si), caustic soda, sodium chlorate, mercury fulminate, calcium carbide, and electrolytic copper in Russia at the average prices ruling in 1913 (viz. about 12s., 83s., 41s., 18s., 70s., 59s., 20s., and 91s. per cwt., respectively) the cost of electrical energy per kilowatt-hour should not exceed 0.06d., 0.15d., 0.16d., 0.4d., 0.62d., 0.7d., 1.15d., and 1.25d., respectively; while for purely electrochemical uses the maximum cost should be from 0.025 to 0.125d. per kilowatt-hour. By erecting power stations at centres where coal and peat are abundant, utilising the waterfalls in Finland, the Urals, and the Caucasus, and imposing very high protective duties, it is hoped to give the necessary impulse and ensure the development of Russian electrical and electrochemical industries.

Until the outbreak of war, the Russian chemical and pharmaceutical market was mainly dependent on German imports. To remedy this situation and create an independent Russian industry, the Association for the Development of the Chemical and Pharmaceutical Industries in Russia was founded at Moscow, and commenced operations in Sept., 1914. Since that date many pharmaceutical and other products have been manufactured under the auspices of the Association; among these may be mentioned chloroform, caffeine, atropine, iodine and iodine products, citric acid, derivatives of cresotic and guaiacolic, acetylsalicylic acid, pyrimidin, salol, formalin, hydrogen peroxide, mercury salts, sodium salicylate, β -naphthol, anisol, various alkaloids, sulphuric ether, acetic anhydride, ethyl chloride, "terpineol hydrate," and lanoline. Similar efforts in the domain of industrial chemical products are being made by the Association des Propriétaires d'Usines et des Industriels de la Russie, and the Association des Fabricants de Cottonnades, the latter being specially concerned in extending and bringing up to date the country's colour works. Independently of this, the principal textile manufacturers of Moscow have decided to establish a works for the production of coal-tar colours and the necessary intermediate products, and to place the construction and management of the works under Swiss control; it is certain that Russia possesses an adequate supply of primary materials, particularly coal-tar, for the colour industry. The large quantities of indigo (13,000 cwt. in 1913), mineral pigments, tanning materials, etc., annually imported before the war have now sensibly diminished owing to domestic production; while

the export of glycerin (over 30,000 cwt. in 1914) has entirely ceased, owing to the home demand. The wood-distillation industry formerly flourished when the sale of methyl alcohol was profitable, but was adversely affected by competition with denatured alcohol; the position has been somewhat modified since the war, owing to the increased demand for pyroligneous acid and acetone. Wood tar and turpentine are mainly produced in the Perm district, where 100 plants are in operation; the Ural district possesses only two wood-distilling works, both of which produce pyroligneous acid and methyl alcohol. The match industry of Russia is conducted in 114 factories which, in 1914, produced 4,000,000 cases of 1000 boxes, of which 300,000 cases (about 78,000 cwt.) were exported.—W. E. F. P.

Prohibited exports. Order in Council, Sept. 29, 1916. THE following alterations have been made in the Proclamation of May 10, 1916 (see this J., 1916, 620):—

Headings deleted. ¹Iron and steel plates and sheets. ²Steel, and steel articles containing chrome, cobalt, nickel, or vanadium. ³Goods made wholly or partly of rubber, gutta-percha, or balata.

New headings: ²Molybdic acid and its salts. ³Gauze made of copper or its alloys. ³Matches. ¹Steel articles containing chrome, cobalt, nickel, or vanadium. ¹Iron and steel plates and sheets except when made from crucible cast steel or from carbon steel not made in the United Kingdom by the Siemens or Bessemer processes, provided such crucible or carbon steel does not contain more than 5% of chrome, cobalt, nickel, or vanadium. ³Goods made wholly or partly of rubber, gutta-percha, or balata (except rubber hose covered with steel wire). ¹Rubber hose covered with steel wire.

Note: The exportation of the goods mentioned above is prohibited as follows:—Goods marked ¹, to all destinations. Goods marked ², to all ports and destinations abroad other than ports and destinations in British Possessions and Protectorates. Goods marked ³, to all destinations in foreign countries in Europe and on the Mediterranean and Black Seas, other than France and French Possessions, Russia, Italy and Italian Possessions, Spain, and Portugal, and to all ports in any such foreign countries, and to all Russian Baltic ports.

Prohibited imports. Royal Proclamation, Oct. 3, 1916.

THE importation of aluminium powder, and of manufactures of bone, horn, ivory, and celluloid is prohibited (except under licence).

Contraband of war. Royal Proclamation, Oct. 3, 1916.

THE following are made absolute contraband:—Insulating materials (raw and manufactured), fatty acids, cadmium, cadmium alloys, and cadmium ore, albumin, waxes of all kinds. Yeast is added to the list of conditional contraband.

France: Prohibited exports.

THE exportation from France of the following has been prohibited:—Arsenical ores, asphalts, bitumens, and pitch, bituminous limestone, borax, boric acid and other boron compounds, chromic acid, chromates and bichromates, fatty acids, feldspar, formic ether, glues of all kinds and substances used for preparing them (casein, egg albumin, serum albumin, dried blood, dextrin and soluble starches, gelatin, glue and size, scraps of skin and leather, animal waste), halogen compounds of carbon, chlorides of metals and metalloids, sodium, spermaceti, varnish.

